STATE OF ILLINOIS
WILLIAM G. STRATTON, *Governor*
DEPARTMENT OF REGISTRATION AND EDUCATION
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CERAMIC TESTS OF ILLINOIS CLAYS AND SHALES

Compiled by
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J. E. Lamar

DIVISION OF THE
ILLINOIS STATE GEOLOGICAL SURVEY
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URBANA

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ABSTRACT

More than 125 ceramic tests of Illinois clays and shales, compiled from the files of the Illinois State Geological Survey, are presented to make available information regarding the ceramic properties of a wide variety of clays and shales in 59 counties.

INTRODUCTION

In past years a number of clay and shale samples have been collected by members of the Illinois State Geological Survey in connection with various investigations for which it has not been feasible to publish reports. Detailed ceramic tests were made on many of the samples and have been available for reference at the Survey offices. Many of the samples were taken from areas for which no published ceramic data exist or from materials on which no ceramic tests had been published. For this reason, and in order that the data may be more conveniently accessible, they are here compiled,together with brief notes concerning the deposits sampled.

Some of the samples came from commercial deposits being worked at the time, others were taken because they constituted potential resources in certain areas, and still other samples are clays of unusual appearance or mode of occurrence. It is believed that those parts of commercially operated deposits which were sampled have long since been removed; such tests, therefore, do not necessarily duplicate materials currently produced from the deposits. Nevertheless, they represent the clay or shale of a given geological formation or a rock unit and hence suggest what may be expected of other deposits of the same unit.

The sample prefix letter or letters indicate who collected the samples: NF samples - J. E. Lamar and H. B. Willman; W samples - H. B. Willman; R samples - T. B. Root. Others who sampled deposits or described them are R. M. Grogan, A. H. Bell, W. C. Krumbein, and H. R. Wanless. Samples identified by number only were collected by W. A. White and W. E. Parham. The stratigraphic names of the various strata sampled have been provided by H. B. Willman and J. A. Simon.

CERAMIC TESTS

The detailed tests given herein were made for the Illinois State Geological Survey by members of the Department of Ceramic Engineering of the University of Illinois. The late Professor C. W. Parmelee made many of the tests, a lesser

number were made by the late Professor R. K. Hursh and by Professor C. G. Harman. The less detailed tests which follow were made by Survey personnel.

Ceramic tests of Illinois clays and shales appear in a number of other available Survey publications, especially the following:

Paving brick and paving-brick clays of Illinois: C. W. Rolfe, A. N. Talbot, R. C. Purdy, and I. O. Baker. Bulletin 9, 1909.

Further investigations of Illinois fireclays: C. W. Parmelee and C. R. Schroyer. Bulletin 38D, 1921.

Geology and mineral resources of the Marseilles, Ottawa, and Streator Quadrangles: H. B. Willman and J. N. Payne. Bulletin 66, 1942.

Geology and mineral resources of the Carlinville Quadrangle: J. R. Ball. Bulletin 77, 1952.

Tests on clay materials available in Illinois coal mines: R. T. Stull and R. K. Hursh. Mining Investigations Bulletin 18, 1917.

Refractory clays in Calhoun and Pike Counties, Illinois: J. E. Lamar. Report of Investigations 22, 1931.

Clay and shale resources of extreme southern Illinois: J. E. Lamar. Report of Investigations 128, 1948.

Light-burning clay resources in LaSalle County, Illinois: W. E. Parham. Circular 277, 1959.

Still other tests appear in the Survey's Report of Investigations 72, "Petrographic and ceramic properties of Pennsylvanian shales of Illinois," by Ralph E. Grim. This report is out of print but also appears in the Journal of the American Ceramic Society, vol. 24, no. 1, p. 23-28, 1941, where it may be consulted.

DISTRIBUTION AND DESCRIPTION OF SAMPLES

Figure 1 shows the distribution of samples and indicates whether the samples are surface clays, clays of Cretaceous age, clays or shales of Pennsylvanian age, or shales or clays older than Pennsylvanian age or of uncertain age.

The following descriptions of samples and tests are arranged by counties.

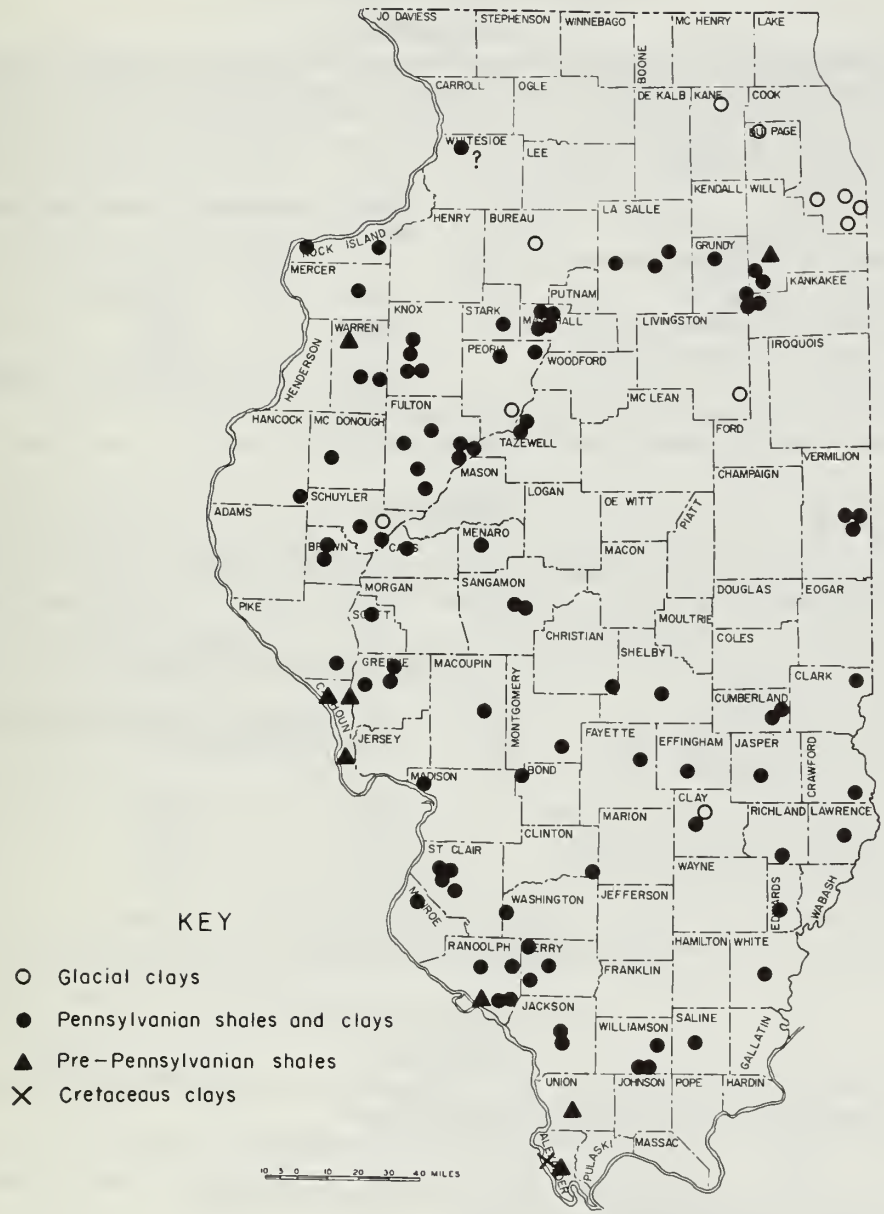

Fig. 1 - Locations from which samples of clays and shales were taken for ceramic tests.

ALEXANDER COUNTY

SAMPLE 1423

NW¼ NW¼ sec. 21, T. 15 S., R. 3 W. Illinois Minerals Company pit about 1½ miles south of Thebes along east Mississippi River bluff east of Missouri Pacific Railroad, back of farm house.

About 6 to 8 feet of blue-gray clay exposed; thickness of the overburden may range from 0 to 30 feet.

Material: clay — Age: Cretaceous - Tuscaloosa Formation
Water of plasticity, percent 23 — Workability: good
Linear drying shrinkage, percent 3.64

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	20.09	2.61	6.78
Total linear shrinkage, percent	5.73	6.25	10.42
Fired colors	Buff	Dark buff	Brownish tan

Remarks: firing temperature 1900°F to over 2000°F
Suggested uses: structural clay products, drain tile, pottery, and flower pots.

SAMPLE 1424

SE¼ SE¼ sec. 28, T. 15 S., R. 3 W. About 1 mile north of Fayville. In north cut bank of ravine in east bluff of Mississippi River about one-eighth mile east of Missouri Pacific Railroad. The hollow contains remains of an old abandoned powder plant.

About 20 feet of dark gray, well laminated shale is exposed with about 40 feet of Eocene clays and sand and Pleistocene loess as overburden.

Material: shale — Age: Silurian - Orchard Creek Shale
Water of plasticity, percent 19 — Workability: good
Linear drying shrinkage, percent 3.12

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	3.12	3.65	3.13
Total linear shrinkage, percent	6.25	6.77	6.25
Fired colors	Salmon	Red	Red

Remarks: overfired at 2012°F. Firing range is probably from 1850° to about 1950°F
Suggested uses: structural clay products, drain tile, and flower pots.

BOND COUNTY

SAMPLE 1415

NE¼ NW¼ sec. 13, T. 6 N., R. 5 W. Richards Brick Company pit about 3 miles east of New Douglas, south side of blacktop road.

Four feet of weathered Illinoian till as overburden.

Material: shale — Age: Pennsylvanian - Bond Formation
Water of plasticity, percent 24 — Workability: good
Linear drying shrinkage, percent 3.64

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	5.21	5.21	7.35
Total linear shrinkage, percent	8.85	8.85	10.99
Fired colors	Salmon	Salmon	Red

Remarks: firing range long
Suggested uses: structural clay products, drain tile, and flower pots.

BROWN COUNTY

SAMPLE 1337 A

SE¼ SE¼ NW¼ sec. 24, T. 1 S., R. 4 W. North shale pit of Frederic Brick and Tile Company, north of gravel road in west cut bank of Dry Fork Creek.

Bottom 10 feet of face sampled, blue-gray shale.

Material: shale
Age: Pennsylvanian - Carbondale Formation
Water of plasticity, percent 19
Workability: good
Linear drying shrinkage, percent 2.34

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	4.95	8.64	6.51
Total linear shrinkage, percent	7.29	10.98	8.85
Fired colors	Salmon	Red	Red

Remarks: some bloating at 2012°F
Suggested uses: structural clay products, drain tile, and flower pots.

SAMPLE 1351

SW¼ SW¼ NE¼ sec. 8, T. 1 S., R. 3 W. About one-fourth mile north of Mt. Sterling on east side of Illinois Highway 99 on south cut bank of stream east of highway fence.

Five feet of underclay underlying a thin limestone.

Material: underclay
Age: Pennsylvanian - Carbondale Formation
Water of plasticity, percent 18
Workability: good
Linear drying shrinkage, percent 4.68

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	1.05	2.09	3.13
Total linear shrinkage, percent	5.73	6.77	7.81
Fired colors	Salmon	Salmon	Red

Suggested uses: structural clay products, drain tile, and flower pots.

BUREAU COUNTY

SAMPLE NF 256

NE¼ NW¼ NW¼ sec. 34, T. 17 N., R. 8 E. Sampled 1934.

Strata exposed in gravel pit:

		ft.
3.	Clay, silty (loess) (sample NF 256)	11
2.	Gravel	7-10
1.	Sand, pebbly	3-7
	Covered	

Age: Pleistocene - Wisconsinan - Richland loess

Characteristics of Unfired Material

Color: yellow
Working properties: fair - a little short
Hardness: very friable
Drying shrinkage, percent: linear 5.7
Reaction for carbonates: cold - trace
volume 18.2
hot - trace
Drying conduct: poor - tends to crack
Reaction for pyrite: negative
Screen test: residue on 35-mesh screen - 0.32 percent; mainly rounded quartz grains; some roots, limonite, and granite pebbles

BUREAU COUNTY - continued

SAMPLE NF 256 - continued

Characteristics of Fired Material

Cone	Absorption %	Porosity %	Color	Hardness	Burning shrinkage % Linear	Burning shrinkage % Volume	Remarks
06	18.1	31.7	Salmon	2½	0.0	0.0	Slightly scummed
1	13.5	25.0	Red	6	2.6	7.5	Slightly scummed
3	8.0	16.5	Red	7	5.5	16.5	
6	3.0	2.0	Chocolate	9	4.8	13.7	Overfired

Oxidation conduct: easily oxidized
Soluble salts: sulfates present
Warpage: none
Suggested uses: face or common brick.

CALHOUN COUNTY

SAMPLE R 104

West-central part, SW¼ SE¼ sec. 3, T. 9 S., R. 2 W. Sampled 1930.
Eleven feet of lower part of the Hannibal Shale. Age: Mississippian.

Characteristics of Unfired Material

A hard shale of a blue and black color having a stony fracture which requires 22.2 percent water to bring it to a suitable working condition. It then has a medium-soft consistency and a "mealy" feel that changes rather rapidly as the water content is increased or decreased. A value of 241 pounds per square inch for the modulus of rupture indicates a medium bonding strength.

When slaked and washed through a 40-mesh sieve, the 67.5 percent residue consists of unslaked material that is high in siliceous particles, pyrites, and a black iron-containing mineral.

The plastic material dries rapidly in the open air without apparent defects and shows a shrinkage of 5.8 percent.

The raw material reacts freely with cold hydrochloric acid, giving a lively effervescence that indicates the presence of carbonates.

Characteristics of Fired Material

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Linear shrinkage % Total
05	22.2	Red-brown	Steel hard	2.7	8.5
02	12.0	Red-brown	Steel hard	4.5	10.3
1	0.6	Red-brown	Steel hard	1.6	4.2
2	2.6	Red-brown	Steel hard	1.2	7.0
3	0.8	Chocolate	Steel hard	4.8	1.0

Oxidation conduct is only fair.

The porosities and shrinkages indicate overburning after cone 1. The color is unattractive and the surface texture is rough.

Suggested uses: common brick, hollow ware.

C A L H O U N C O U N T Y - continued

SAMPLE 1349 A

NE¼ NE¼ NE¼ sec. 11, T. 9 S., R. 3 W. Southwest of Illinois Highway 96, southwest cut bank of tributary to Fox Creek, behind farm buildings, about 5 miles west of Kampsville.

Lower 15 feet of blue-gray shale.

Material: shale — Age: Mississippian - Hannibal Shale
Water of plasticity, percent 19 — Workability: good
Linear drying shrinkage, percent 3.99

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	1.74	2.26	Bloated
Total linear shrinkage, percent	5.73	6.25	
Fired colors	Salmon	Salmon	

Remarks: short firing range
Suggested uses: structural clay products, drain tile, and flower pots.

SAMPLE 1352 A

SW¼ NE¼ SW¼ sec. 17, T. 11 S., R. 2 W. About 5 miles north of Batchtown on west side of road in east bluff of Mississippi River Valley.

The sample represents the middle 20 feet of blue-gray, thinly laminated shale.

Material: shale — Age: Ordovician - Maquoketa Shale
Water of plasticity, percent 23 — Workability: good
Linear drying shrinkage, percent 3.82

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	6.60	7.17	Bloated
Total linear shrinkage, percent	10.42	10.99	
Fired colors	Red	Red	

Remarks: firing range short
Suggested uses: structural clay products, drain tile, and flower pots.

C A S S C O U N T Y

SAMPLE R 510

SW¼ SW¼ NE¼ sec. 11, T. 18 N., R. 11 W. Outcrop back of Cottonwood School. Sampled 1932.

Sample from 5 feet of gray, soft shale containing scattered ironstone concretions. Age: Pennsylvanian - Carbondale Formation - Francis Creek Shale

Characteristics of Unfired Material

Reaction for carbonates: none — Reaction for pyrites: none
Color: light gray — Hardness: scratched with fingernail
Working property: works well and has good plasticity — Water of plasticity, percent: 31.3
Modulus of rupture: 242 lbs. per sq. in. — Number of briquets: 12

Fineness

Residue on 48-mesh: 1 percent was slaked by rubbing
Character of residue: clay-bonded quartz

CASS COUNTY - continued

SAMPLE R 510 - continued

Drying

Air shrinkage, plastic basis, percent: 6.3 Dry basis, percent: linear 8.3
volume 22.8

Characteristics of Fired Material

Cone	Absorption	Color	Hardness	Linear shrinkage % Burning	Total
010	19.6	Salmon-buff		0.2	8.5
07	12.6	Salmon		4.2	12.5
01	0.28	Brown	Steel hard	12.4	20.7
3	0.28	Brown		11.6	19.9

Remarks

Drying shrinkage: medium (plastic basis)
Flexural strength: medium
Burning shrinkage: high-medium
Color range: O. K.
Plasticity: good
Vitrification: practically zero from cone 01 to cone 3

Suggested uses: sewer, common, hollow, face, glazed, enameled brick; fireproofing; quarry, roofing, encaustic, floor, faience, and tesseral tile; drain tile and pottery not salt-glazed.

CHRISTIAN COUNTY

SAMPLE 1428

SE¼ NE¼ sec. 23, T. 11 N., R. 1 E. About 1½ miles south of Pana in north cut bank of ravine about 100 yards west of U. S. Highway 51.

About 8 feet of weathered gray shale is exposed.

Material: shale
Water of plasticity, percent 20
Linear drying shrinkage, percent 2.08
Age: Pennsylvanian - Mattoon Formation
Workability: fair

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	1.56	1.56	7.82
Total linear shrinkage, percent	3.64	3.64	9.90
Fired colors	Salmon	Salmon	Red

Suggested uses: structural clay products, drain tile, and flower pots.

CLARK COUNTY

SAMPLE 1345

NE¼ NE¼ SW¼ sec. 16, T. 11 N., R. 11 W. About 2½ miles east of Marshall and about 1 mile south of Livingston in southwest cut bank of Big Creek.

About 15 feet of dark gray, well laminated shale exposed.

Material: shale
Water of plasticity, percent 18
Linear drying shrinkage, percent 1.90
Age: Pennsylvanian - Bond Formation
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	1.75	4.35	6.95
Total linear shrinkage, percent	3.65	6.25	8.85
Fired colors	Salmon	Salmon	Red

CLARK COUNTY - continued

SAMPLE 1345 - continued

Remarks: high organic content in shale may be difficult to oxidize
Suggested uses: structural clay products and drain tile.

CLAY COUNTY

SAMPLE 1420

SE¼ NW¼ sec. 19, T. 4 N., R. 6 E. About 3½ miles west of Louisville, in road ditch west of farm house.

Brownish gray shale with one-fourth inch laminae, thin overburden; 3 feet exposed; topography fairly flat.

Material: shale
Water of plasticity, percent 23
Linear drying shrinkage, percent 2.60
Age: Pennsylvanian - Mattoon Formation
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	2.61	4.17	8.34
Total linear shrinkage, percent	5.21	6.77	10.94
Fired colors	Salmon	Salmon	Red

Suggested uses: structural clay products, drain tile, and flower pots.

SAMPLE B 18

Roadcut SE corner SW¼ NE¼ sec. 35, T. 5 N., R. 6 E. Sampled 1937. Age: Pleistocene - Illinoian.

Exposure consists of:	ft.	in.
5. Soil		6
4. Silt, hard, brown or gray	1	
3. Clay (gumbotil?), gray and brown (sample B 18)	3	6
2. Gumbo sand, brown	1	6
1. Silt, gray, slightly calcareous	1	
Covered		

Characteristics of Unfired Material

Color: gray and brown
Hardness: readily crumbled with the fingers
Fracture: irregular
Reaction for pyrite: none
Soluble salts: sulfates present
Reaction for carbonates: none
Water of plasticity, percent: 32.2; shrinkage water, percent: 18.8; pore water, percent: 13.4
Slaking time: 100 percent clay, 17½ minutes; 50 percent clay — 50 percent flint, 4 minutes
Drying conduct: tendency to crack in drying, apparently caused by the high shrinkage characteristics of one of the clay minerals present. The clay, however, could be dried commercially without too much trouble. Scum can be noted on the drying ware but not on the fired pieces.
Working properties: fair. The clay is coarse and sandy, but contains sufficient quantities of a highly plastic clay mineral to render the sample sticky and glue-like. Can be extruded with success.
Drying shrinkage, percent: linear 10.7; volume 35.7
Modulus of rupture: dry clay - 990 lbs. per sq. in. - 15 specimens; with 50 percent standard sand - 250 lbs. per sq. in. - 13 specimens

C L A Y C O U N T Y - continued

SAMPLE B 18 - continued

Screen test:

Residue on	Percent	Character of residue
10-mesh	2.15	90 percent quartz (clear, brown, white, rose), somewhat rounded; limonite, about 8 percent; remainder, roots and chert
20-mesh	1.10	About the same as on 10-mesh
35-mesh	3.95	95 percent quartz grains, mostly clear; few chert fragments; some roots and about 2 or 3 percent limonite; residue resembles river sand
65-mesh	10.15	Mostly clear quartz grains; some limonite
100-mesh	4.22	Same as on 35-mesh
150-mesh	2.12	Same as on 35-mesh
200-mesh	2.61	Same as on 35-mesh, including a trace of hematite

Characteristics of Fired Material

Cone	Absorption %	Porosity %	Color	Hardness	Burning shrinkage % Linear	Burning shrinkage % Volume	Total shrinkage % Linear	Total shrinkage % Volume
011	14.2	26.6	Light red	6	0.07	0.2	10.5	35.5
06	13.6	26.0	Light red	6	0.5	1.4	11.2	37.1
02	10.6	22.9	Red	6	1.9	5.7	12.6	41.4
2	11.0	26.0	Fine red	6	2.0	5.9	12.7	41.6
4	11.8	23.3	Fine red	7	2.0	5.9	12.7	41.6
7	8.0	16.4	Chocolate	8	2.9	8.5	13.6	45.6
8½	5.1	10.8	Chocolate	8	3.9	11.3	14.6	48.4

Oxidation conduct: very easy to oxidize Remarks: bends uniformly
PCE value (fusion test): cone 15 Warpage: none
Remarks: the clay has high drying shrinkage; the firing shrinkage is uncommonly low, and it can be matured over a wide temperature range. The color of the fired clay is especially noteworthy, being a very fine brilliant red.
Suggested uses: this clay could be used for the manufacture of face brick. The fine red color and the excellent adhesive qualities suggest that the clay may have potential value as a coating to apply to face brick to produce a good red color. The texture, as well as the color, is unusual, being almost devoid of gloss.

C L I N T O N C O U N T Y

SAMPLE 1414

SW¼ sec. 1, T. 1 N., R. 1 W. About 1½ miles northwest of Centralia in south cut bank of Crooked Creek east of bridge.

Eight feet of shale on limestone; overlain by sand and gravel.

Material: shale Age: Pennsylvanian - Bond Formation
Water of plasticity, percent 20 Workability: good
Linear drying shrinkage, percent 2.08

CLINTON COUNTY - continued

SAMPLE 1414 - continued

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	4.17	4.17	8.32
Total linear shrinkage, percent	6.25	6.25	10.42
Fired colors	Salmon	Salmon	Red

Suggested uses: structural clay products, drain tile, and flower pots.

COOK COUNTY*

SAMPLE NF 238

SE¼ SE¼ SW¼ sec. 28, T. 35 N., R. 14 E. Sampled 1934. Age: Pleistocene - Wisconsinan - Tinley till.

Strata exposed are:	ft.	in.
3. Soil		6
2. Till, brown	12	
1. Till, gray and brown (sample NF 238) Covered	18	

Characteristics of Unfired Material

Material: till
Color: gray
Reaction for carbonates: yes
Reaction for pyrites: present
Soluble salts: sulfates present
Friability: crushable between fingers with reasonable force
Working properties: very good
Water of plasticity, percent: 28.1; shrinkage water, percent: 14.1; pore water, percent: 14
Slaking time: 100 percent clay, 11 minutes, 20 seconds; 50 percent clay — 50 percent flint, 16 minutes
Modulus of rupture, dry clay: 714 lbs. per sq. in. - 12 specimens
Drying shrinkage, percent: linear 8.2; volume 26.6
Drying conduct: satisfactory; easily dried

Screen test:

Residue on	Percent	Character of residue
10-mesh	1.20	Mostly sandstone and limestone; pyrite in minor amounts
20-mesh	0.93	Mostly sandstone and limestone; pyrite in minor amounts
35-mesh	0.90	Mainly limestone and quartz; some pyrite
65-mesh	1.00	Same as 35-mesh
100-mesh	1.10	Limestone, calcite, and quartz
150-mesh	0.06	Quartz and limestone; some siderite
200-mesh	0.00	

Characteristics of Fired Material

Cone	Absorption %	Porosity %	Color	Hardness	Burning shrinkage % Linear	Burning shrinkage % Volume	Total shrinkage % Linear	Total shrinkage % Volume
011	21.2	36.5	Flesh	4	1.2	3.5	9.4	30.1
06	22.2	37.1	Peach	4+	1.2	3.4	9.4	29.0
02	19.5	33.7	Pink	6	4.2	12.1	12.4	38.7

*Also sample NF 230, p. 71.

COOK COUNTY - continued

SAMPLE NF 238 - continued

Characteristics of Fired Material - continued

Cone	Absorption %	Porosity %	Color	Hardness	Burning shrinkage % Linear	Burning shrinkage % Volume	Total shrinkage % Linear	Total shrinkage % Volume
1	11.8	24.3	Reddish brown	7-8	8.8	24.1	17.0	50.7
2	7.2	15.4	Reddish brown	8-9	8.9	24.5	17.1	51.1
4	0.00	-	Chocolate	9	13.6	35.6	21.8	62.2
5	Melts							

Remarks: at cones 011 and 06 specimens were slightly scummed and had lime pops. At cone 02 the specimens were slightly scummed with light spots. At cones 1, 2, and 4 the specimens were spotted with light buff.
Oxidation conduct: easily oxidized
PCE (fusion test): cone 5; cones of this clay did not bend; they melted and slumped suddenly
Warpage: none
Suggested uses: common brick or drain tile. It cannot be vitrified commercially owing to its lack of vitrification range.

SAMPLE NF 232

SW¼ NE¼ NW¼ sec. 30, T. 36 N., R. 15 E. Sampled in 1934.

Material: glacial till Age: Pleistocene - Wisconsinan

Exposure in pit of Illinois Brick Company at Bernice:

		ft.
4.	Soil and leached glacial till	2
3.	Till (Park Ridge), yellow-gray and brown mottled	6
2.	Silt, gray and yellow	12
1.	Till (Tinley), gray, practically pebble free, locally thin silt bands (sample NF 232)	20
	Covered	

Characteristics of Unfired Material

Reaction for carbonates: yes Reaction for pyrites: present
Color: gray Soluble salts: sulfates present
Friability: crushable between fingers Working properties: very good
Water of plasticity, percent: 22.2; shrinkage water, percent: 9.0; pore water, percent: 13.2
Slaking time: 100 percent clay, 10 minutes; 50 percent clay — 50 percent flint, 40 minutes
Drying shrinkage, percent: linear 5.76; volume 18.3
Drying conduct: satisfactory; easy to dry

Modulus of rupture:	Lbs. per sq. in.	No. of specimens
Dry clay	390	7
With 50 percent standard sand	201	13

Screen test:

Residue on	Percent	Character of residue
10-mesh	3.45	Limestone and sandstone in about equal portions; about 25 percent of the residue is fragments of a black ferromagnesian rock; a few fragments of pyrite are present

COOK COUNTY - continued

SAMPLE NF 232 - continued

Screen test - continued

Residue on	Percent	Character of residue
20-mesh	1.46	
35-mesh	2.01	Same as 10-mesh
65-mesh	2.50	Sandstone, limestone, and quartz
100-mesh	1.15	Sandstone, limestone, and quartz
150-mesh	1.15	Sandstone, limestone, and quartz
200-mesh	1.27	Sandstone, limestone, and quartz

Characteristics of Fired Material

Cone	Absorption %	Porosity %	Color	Hardness	Burning shrinkage % Linear	Burning shrinkage % Volume	Total shrinkage % Linear	Total shrinkage % Volume
011	20.1	34.5	Light buff	4	0.77	2.3	6.5	20.6
06	19.7	33.4	Cream	4	0.5	1.5	6.3	19.8
02	18.5	32.1	Light buff	5	1.3	3.7	7.1	22.0
2	9.9	19.8	Dark buff	5-7	8.1	22.2	13.9	40.5
2½	8.1	16.5	Greenish buff	8	8.4	23.2	14.2	41.3
4	0.6	1.4	Greenish buff	9	10.8	29.1	16.6	47.1
5	Melts							

Remarks: the specimen at cone 2 was not uniform owing to rapid changes with temperature. Fired clay is speckled with cream spots caused by concentrations of limy clay or pebbles.

Oxidation conduct: easily oxidized Soluble salts: sulfates present

PCE value (fusion test): cone 5; cones of this clay did not bend; they melted and slumped suddenly

Warpage: none

Suggested uses: common brick or drain tile. It cannot be vitrified commercially owing to lack of vitrification range.

SAMPLE D 7

SE¼ SE¼ sec. 33, T. 39 N., R. 13 E. Sampled in 1932.

Material: glacial till Age: Pleistocene - Wisconsinan

Exposure consists of:

	ft.
3. Soil, black	1½
2. Sand, brown, silty, calcareous	2
1. Till (Lake Border), dark gray (sample D 7)	20
Covered	

Characteristics of Unfired Material

Reaction for carbonates: yes Reaction for pyrites: yes

Color: light gray, almost white Hardness: 1 on Moh's scale

Working property: sticky Water of plasticity, percent: 25.4

Number of briquets: 13 Modulus of rupture: 450 lbs. per sq. in.

Fineness

Residue on 48-mesh, percent: 8.4 Character of residue: limestone, granite, limonite, quartz, igneous rocks, etc.

COOK COUNTY - continued

SAMPLE D 7 - continued

Drying

Air shrinkage, plastic basis, percent: 6.78 Dry basis, percent: linear 8.5
volume 23.4

Characteristics of Fired Material

Cone	Absorption %	Color	Hardness	Linear shrinkage % Burning	Total
010	21.9	Light buff	Scratched	0.1	8.6
07	20.6		Scratched	0.3	8.8
01	11.8	Greenish brown with white spots	Steel hard	4.9	13.4
2	0.3	Light brown with white spots		8.7	17.2

Remarks

Drying shrinkage: medium (plastic basis) Color: variable
Flexural strength: high-medium Plasticity: sticky
Vitrification conduct: rapid after cone 01 Burning shrinkage: medium (cone 03)
Suggested uses: limy brick, common brick, possibly hollow ware.

CRAWFORD COUNTY

SAMPLE 1421

SW¼ SW¼ NE¼ sec. 1, T. 5 N., R. 12 E. About three-fourths mile west of Flatrock in west bank of ravine inside fence north of bridge, west of farm house.
Three feet of gray shale exposed; overburden would be thin in this area.

Material: shale Age: Pennsylvanian - Bond Formation?
Water of plasticity, percent 18 Workability: fair
Linear drying shrinkage, percent 1.56

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	3.12	4.17	7.81
Total linear shrinkage, percent	4.68	5.73	9.37
Fired colors	Salmon	Salmon	Red

Remarks: ferrous sulfate scumming; this scumming would not occur in unweathered shale
Suggested uses: structural clay products, drain tile, and flower pots.

CUMBERLAND COUNTY

SAMPLE 1353 A

NE¼ NW¼ SW¼ sec. 36, T. 10 N., R. 9 E. About 1 mile north of Greenup in south cut bank of Bell Creek about 50 yards west of old road west of Illinois Highway 130.
Ten feet of dark gray shale.

Material: shale Age: Pennsylvanian - Mattoon Formation
Water of plasticity, percent 21 Workability: poor
Linear drying shrinkage, percent 1.56

CUMBERLAND COUNTY - continued

SAMPLE 1353 A - continued

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	3.13	6.25	7.34
Total linear shrinkage, percent	4.69	7.81	9.90
Fired colors	Salmon	Salmon	Red

Remarks: shale may be difficult to oxidize owing to the organic content
Suggested uses: drain tile.

SAMPLE 1346 A

NW¼ NW¼ SW¼ sec. 2, T. 9 N., R. 9 E. Northwest corner of Greenup, roadcut along east side of Illinois Highway 121 in south bluff of Embarrass River.
Lower 10 feet of shale; shale in this area ranges from 30 to 40 feet thick.

Material: shale
Water of plasticity, percent 20
Linear drying shrinkage, percent 2.08
Age: Pennsylvanian - Mattoon Formation
Workability: fair

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	2.09	4.17	4.17
Total linear shrinkage, percent	4.17	6.25	6.25
Fired colors	Salmon	Salmon	Red

Remarks: test brick bloated some at 2012°F
Suggested uses: structural clay products, drain tile, and flower pots.

DU PAGE COUNTY

SAMPLES NF 147 and 148

SE¼ NW¼ NE¼ sec. 4, T. 40 N., R. 9 E. Sampled in 1933. A concrete road crossing a peat bog in the West Chicago moraine caused a heave of peat and of the clay underlying it. Sample NF 147 was dark gray clay and NF 148 dark gray, woody clay. Age: Pleistocene - Wisconsinan.

SAMPLE NF 147

Characteristics of Unfired Material

Material: clay taken from below a peat bed
Color: dark gray, uniform
Working property: fair; short and tends to tear rather easily
Reaction for carbonates: negative
Hardness: medium; finely granular fracture

Fineness

Residue, percent: 35-mesh - 0.12
Character of residue: vegetable matter

Drying

Air shrinkage, percent: linear 14.4, volume 49.6
Drying conduct: satisfactory
Scumming: slight

Characteristics of Fired Material

Cone	Absorption %	Color	Hardness
06	38.3	Light salmon	3
02	9.4	Red	6
4	1.8	Deep maroon	8

DU PAGE COUNTY - continued

SAMPLE NF 147 - continued

Remarks: at cone 4, the sample oxidized, reduced, re-oxidized; very great shrinkage
Suggested uses: it may be useful for common brick, but is difficult to form and has excessive burning shrinkage.

SAMPLE NF 148

Characteristics of Unfired Material

Material: clay taken from beneath a peat bed
Color: dark gray, uniform
Hardness: medium; granular fracture
Reaction for carbonates: negative
Working properties: slightly difficult to temper; too short to attempt any wedging

Fineness

Residue, percent: 35-mesh — after several days' agitation, 11 percent still unslaked
Character of residue: mineral impurities are not suspected

Drying

Air shrinkage, percent: linear 11.0, volume 36.7
Drying conduct: satisfactory
Scumming: none

Characteristics of Fired Material

Cone	Absorption %	Color	Hardness
06	75.0	Tan	0
02	27.8	Red	3
4	3.5	Maroon	8

Remarks: at cone 06, sample crumbled when handled; at cone 4, it had high shrinkage
Suggested uses: not suited for ceramic purposes.

EDWARDS COUNTY

SAMPLE 1326 A

NE¼ NE¼ sec. 11, T. 2 S., R. 10 E. Pit of Albion Brick Company south of Albion.

Twenty feet of blue-gray and buff shale exposed.

Material: shale
Age: Pennsylvanian - Mattoon Formation
Water of plasticity, percent 22
Workability: good
Linear drying shrinkage, percent 3.64

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	4.69	7.34	7.82
Total linear shrinkage, percent	8.33	10.98	11.46
Fired colors	Salmon	Red	Red

Suggested uses: structural clay products, drain tile, and flower pots.

EFFINGHAM COUNTY

SAMPLE 1416

NW¼ SW¼ sec. 1, T. 6 N., R. 5 E. About 4 miles northeast of Mason on north side of Illinois Highway 37 about 100 yards west of Illinois Central Railroad.

About 4 feet of shale exposed in roadcut, and overburden would be shallow.

EFFINGHAM COUNTY - continued

SAMPLE 1416 - continued

Material: shale — Age: Pennsylvanian - Mattoon Formation
Water of plasticity, percent 20 — Workability: good
Linear drying shrinkage, percent 3.12

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	0.52	1.05	4.17
Total linear shrinkage, percent	3.64	4.17	7.29
Fired colors	Salmon	Salmon	Red

Remarks: scumming
Suggested uses: drain tile, structural clay products if scumming could be controlled.

FAYETTE COUNTY

SAMPLE 1427

NE¼ NE¼ sec. 28, T. 7 N., R. 3 E. About one-fourth mile west of St. Elmo, north of Pennsylvanian Railroad and south of county road.

About 20 feet of blue-gray shale which contains siderite concretions.

Material: shale — Age: Pennsylvanian - Mattoon Formation
Water of plasticity, percent 18 — Workability: good
Linear drying shrinkage, percent 3.64

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	4.69	4.69	4.69
Total linear shrinkage, percent	8.33	8.33	8.33
Fired colors	Salmon	Salmon	Red

Remarks: overburned at 2012°F
Suggested uses: structural clay products and drain tile.

FULTON COUNTY

SAMPLES 611 and 612*

Ravine south of Chicago, Burlington, and Quincy Railroad, NW¼ SE¼ sec. 1, T. 4 N., R. 2 E. Sampled in 1930. Age: Pennsylvanian

		ft.	in.
Carbondale Formation			
11.	Sandstone	60	
10.	Shale	8-11	
9.	Coal (Colchester No. 2 Coal)	2	6
Spoon Formation			
8.	Underclay, gray (sample 612)	4	
7.	Sandstone	4	
6.	Shale and clay	5	
5.	Coal (Wiley Coal)	6	10
4.	Underclay, gray (sample 611)	1	6
3.	Limestone, gray	1	
2.	Sandstone	1	3
1.	Shale, clay, and one-inch coal	11	4
	Covered		

* Wanless, H. R., Geology and mineral resources of the Havana Quadrangle: Illinois Geol. Survey unpub. ms. HRW-4, 1930.

FULTON COUNTY - continued

SAMPLE 611

Characteristics of Unfired Material

Material: clay
Drying conduct: good
Drying shrinkage, percent: linear 7.80
volume 21.85
Water of plasticity, percent: 29.1
Bulk specific gravity: 1.84
Bonding strength: modulus of rupture, 233.80 lbs. per sq. in.

Screen test:

Residue on	Percent
28-mesh	23.9
48-mesh	10.4
65-mesh	2.5
100-mesh	4.9
200-mesh	16.4

Characteristics of Fired Material

Cone	Porosity %	Color	Fracture	Burning shrinkage % Linear	Volume
05	27.44	Salmon	Granular	4.54	13.02
02	20.93	Salmon-buff	Granular	5.08	14.47
2	19.97	Light buff	Granular	5.31	15.09
5	11.54	Pinkish buff	Granular	7.01	19.59
7	7.55	Light tan	Granular	7.84	23.35
10	9.56	Buff with black spots	Granular	7.74	21.49
11	7.64			Bloated	

Fusion test: clay not refractory
Oxidizing conduct: poor
Remarks: drying shrinkage medium; bonding strength medium; vitrification complete between cone 7 and 10; overburned at cone 10; burning shrinkage at vitrification medium-low. It is not refractory.
Suggested uses: drain tile, hollow ware, etc.

SAMPLE 612

Characteristics of Unfired Material

Material: clay
Drying conduct: good
Drying shrinkage, percent: linear 6.58
volume 18.45
Water of plasticity, percent: 24.3
Bulk specific gravity: 1.90
Bonding strength: modulus of rupture, 363.54 lbs. per sq. in.

Characteristics of Fired Material

Cone	Porosity %	Color	Fracture	Burning shrinkage % Linear	Volume
05	15.92	Light buff	Smooth	5.75	16.27
02	9.49	Light buff	Smooth	7.215	20.12
2	1.28	Light tan	Smooth	7.854	21.76
5	3.40	Overburned	Smooth	Bloated	
6	16.05			Bloated	

FULTON COUNTY - continued

SAMPLE 612 - continued

Fusion test: clay not refractory Oxidizing conduct: good
Remarks: drying shrinkage medium; bonding strength medium; vitrification complete at cone 2; overburned at cone 2; burning shrinkage at vitrification medium-low; nonrefractory clay
Suggested uses: building brick, possibly drain tile, hollow tile, etc.

SAMPLES 610 and 613*

NW¼ SE¼ sec. 30, T. 4 N., R. 3 E. Lower part of ravine west of highway. Sampled in 1930. Age: Pennsylvanian - Spoon Formation

Lower part of exposure is:	ft.	in.
4. Shale or clay, gray (sample 613)	4	6
3. Shale, dark gray		2
2. Coal		1½
1. Underclay, gray, with blocky fracture (sample 610)	3	

SAMPLE 610

Characteristics of Unfired Material

Material: clay
Drying conduct: good
Drying shrinkage, percent: linear 6.63, volume 18.22
Water of plasticity, percent: 23.22
Bulk specific gravity: 1.97
Bonding strength: modulus of rupture, 282.8 lbs. per sq. in.

Screen test:

Residue on	Percent
28-mesh	3.7
48-mesh	28.3
65-mesh	7.6
100-mesh	5.4
200-mesh	24.1

Characteristics of Fired Material

Cone	Porosity %	Color	Fracture	Burning shrinkage % Linear	Volume
04	26.25	Cream	Granular	2.14	6.19
02	21.57	Cream	Granular	4.37	12.55
2	21.47	Cream	Granular	6.60	10.42
3	16.99	Light tan	Granular	5.31	15.10
6	9.80	Tan	Granular	6.65	18.64
8	10.20	Bluestoned	Granular	6.86	19.20

PCE value (fusion test): cone 27-28 Oxidizing conduct: poor
Remarks: drying shrinkage medium; bonding strength medium; vitrification incomplete at cone 8; shrinkage at cone 8 medium-low; clay is refractory
Suggested uses: building brick, possibly quarry tile, roofing tile, flue lining, sanitary ware, and stove linings.

* Wanless, H. R., Geology and mineral resources of the Havana Quadrangle: Illinois Geol. Survey unpub. ms. HRW-4, 1930.

FULTON COUNTY - continued

SAMPLE 613

Characteristics of Unfired Material

Material: clay
Drying conduct: good
Drying shrinkage, percent: linear 11.55, volume 30.90
Water of plasticity, percent: 24.10
Bulk specific gravity: 1.91
Bonding strength: modulus of rupture, 248.5 lbs. per sq. in.

Characteristics of Fired Material

Cone	Porosity %	Color	Fracture	Burning shrinkage % Linear	Volume
05	20.11	Tan	Granular	3.80	10.97
02	11.86	Dark tan	Granular	6.42	18.05
2	14.68	Dark tan	Granular	6.34	17.83
4	5.71			Bloated	
7	15.37			Bloated	

Fusion test: clay not refractory
Oxidizing conduct: poor
Remarks: drying shrinkage medium-high; bonding strength, medium; vitrification - overburns suddenly between cones 2 and 4; shrinkage at cone 2 medium-low; non-refractory
Suggested uses: building brick and possibly hollow tile.

SAMPLE R 215

SE¼ SE¼ NW¼ sec. 7, T. 5 N., R. 5 E. Outcrop in the ravine west of road. Sampled in 1931.

Sample from 7 feet, 9 inches of gray-blue shale with scattered small ironstone concretions. Age: Pennsylvanian - Carbondale Formation - Canton Shale.

Characteristics of Unfired Material

The material is a hard, sandy shale that is uniformly gray in color, has a stony fracture, poor plasticity over a short range, and requires 23.9 percent water to develop its normal, moderately soft, working consistency. A low-medium bonding strength is indicated by a value of 165 pounds per square inch for the modulus of rupture.

The material dries fairly rapidly under ordinary atmospheric conditions without difficulty, scums slightly, and has a shrinkage of 4.9 percent.

When slaked and washed on a 40-mesh sieve, 10.1 percent residue remains; the unslaked original material contains considerable mica and some pyrites.

Treatment with hot and cold hydrochloric acid causes mild evolution of gas, indicating the presence of carbonates.

When burned, the clay oxidizes readily and has the vitrification characteristics indicated below.

Characteristics of Fired Material

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Total
04	26.0	Light red		3.4	18.3
01	15.2	Light red		6.7	11.6
1	13.8	Light red	Steel hard	7.3	12.2
3	7.8	Dark red	Steel hard	8.6	13.5
6	2.4	Gunmetal	Steel hard	4.1	9.0

FULTON COUNTY - continued

SAMPLE R 215 - continued

Remarks: this material vitrifies rapidly and reaches a minimum porosity between cone 3 and cone 6. At the latter temperature, it seems slightly overburned. The total shrinkages change little and are high-medium.
Suggested uses: common and face brick, hollow ware. Some traces of soluble salts were noted, which will have an important influence upon the product.

SAMPLE 1322 A

Sec. 7, T. 5 N., R. 5 E. Pine Ridge Coal Company pit. The sample was taken from a bin at Peoria Brick and Tile Company.

Material: shale — Age: Pennsylvanian - Carbondale Formation
Water of plasticity, percent 17 — Workability: fair
Linear drying shrinkage, percent 2.08

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	3.13	5.21	8.34
Total linear shrinkage, percent	5.21	7.29	10.42
Fired colors	Salmon	Salmon	Red

Suggested uses: structural clay products, drain tile, and flower pots.

SAMPLES V 1 - 4

SE¼ sec. 22, T. 6 N., R. 1 E. Railroad cut and ravine. Sampled about 1939. (Section from Wanless, H. R., 1957, Geology and mineral resources of the Beardstown, Glasford, Havana and Vermont quadrangles: Illinois Geol. Survey Bull. 82, p. 201.)

	ft.	in.
Pennsylvanian		
Spoon Formation		
7. Underclay, light gray (sample V 1) below Seahorne Limestone	1	
6. Shale, carbonaceous	3	
5. Underclay, light brownish gray (sample V 2)	1	6
4. Shale, dark blue-gray		6
3. Clay, coaly		1
2. Underclay, light gray (sample V 3)	5	
1. Shale, light gray (sample V 4)	4	

SAMPLE V 1

Characteristics of Unfired Material

Color: light yellow
Hardness: crumbled between fingers with difficulty
Fracture: granular
Reaction for carbonates: cold - negative hot - trace
Working properties: fair - a little too sticky
Drying shrinkage, percent: linear 9.7 volume 32.0
Drying conduct: requires some care in drying
Screen test: residue on 35-mesh screen - 2.4 percent; mainly gypsum; some limonite and some root casts

FULTON COUNTY - continued

SAMPLE V 1 - continued

Characteristics of Fired Material

Cone	Absorption %	Porosity %	Color	Hardness	Burning shrinkage % Linear	Burning shrinkage % Volume	Remarks
06	14.2	27.9	Orange-buff	4½	3.5	10.0	Slightly scummed
2	2.5	5.0	Tan	8	9.1	24.8	Slightly scummed, cream colored specks
6	0.15	0.3	Light brown	9	9.4	25.6	Slightly scummed, cream colored specks

Oxidizing conduct: requires somewhat lengthened oxidation period
Soluble salts: considerable PCE value (fusion test): cone 18
Suggested uses: this material could possibly be used as a bond clay for certain refractory materials, if used in small amounts. It could be used for common brick and face brick if the scumming could be overcome.

SAMPLE V 2

Characteristics of Unfired Material

Color: light gray, flecked with dark gray and yellow
Hardness: shattered between the fingers with difficulty
Fracture: granular
Reaction for carbonates: cold - trace
hot - trace
Soluble salts: plentiful
Working properties: fair, rather too plastic
Drying shrinkage, percent: linear 8.1
volume 26.2
Drying conduct: must be dried slowly
Screen test: residue on 35-mesh screen - 1.1 percent; 50 percent is gypsum; most of the remainder is sandstone, with some coal and limonite

Characteristics of Fired Material

Cone	Absorption %	Porosity %	Color	Hardness	Burning shrinkage % Linear	Burning shrinkage % Volume	Remarks
06	12.5	25.5	Light buff	5	2.1	6.2	Slightly scummed
2	6.7	14.9	Light tan	8	5.6	16.0	Flecked with light and red specks; scum
3		11.6	Light tan	9	6.0	17.2	Same as above
6	4.5	10.2	Light tan	9	7.9	21.8	Same as above

Soluble salts: present
Suggested uses: face and common brick.

SAMPLE V 3

Characteristics of Unfired Material

Color: mixture of yellow and greenish gray clays
Hardness: breaks readily into granules, some of which are very hard
Fracture: granular
Reaction for carbonates: cold - positive
hot - trace
Working properties: works well

FULTON COUNTY - continued

SAMPLE V 3 - continued

Drying shrinkage, percent: linear 8.5 volume 27.7 Drying conduct: dries safely with reasonable care
Screen test: residue on 35-mesh screen - 0.17 percent; nearly all gypsum; some sandstone, coal, and limonite

Characteristics of Fired Material

Cone	Absorption %	Porosity %	Color	Hardness	Burning shrinkage % Linear	Volume	Remarks
06	11.4	21.9	Light buff	6½	4.6	13.1	Scumming
3	0.05	0.01	Tan	9	10.3	27.9	Scummed slightly
6	0.00	0.00	Tan	9	10.4	28.0	

Oxidation conduct: requires some oxidation treatment to prevent bluestoning
Suggested uses: if the scumming can be eliminated, the material would be suitable for buff face brick, terra cotta, stoneware, or some types of pottery.

SAMPLE V 4

Characteristics of Unfired Material

Color: gray
Hardness: easily crushed between the fingers
Fracture: granular
Reaction for carbonates: cold - feeble
Soluble salts: sulfates present
Working properties: good
Drying shrinkage, percent: linear 7.0 volume 22.4
Drying conduct: no difficulty encountered
Screen test: residue on 35-mesh screen - 1.8 percent; mainly limonitic sandstone; calcite present in minor quantities; a few small roots

Characteristics of Fired Material

Cone	Absorption %	Porosity %	Color	Hardness	Burning shrinkage % Linear	Volume	Remarks
06	11.3	23.2	Light buff	6	3.3	9.7	Sulfate scum
2	5.1	11.5	Tan	8	7.9	21.8	Sulfate scum
6	0.1	0.2	Tan	9	9.6	26.0	

Soluble salts: present
Suggested uses: if the scumming can be eliminated, the clay could be used for the manufacture of face brick, terra cotta or stoneware.

SAMPLE 1350 A

Sec. 10, T. 6 N., R. 3 E. Truax Traer Coal Company pit southwest of Fiatt. About 40 feet of blue-gray shale; overburden is 50 to 20 feet.

Material: shale
Water of plasticity, percent 18
Linear drying shrinkage, percent 2.38
Age: Pennsylvanian - Carbondale Formation
Workability: good

FULTON COUNTY - continued

SAMPLE 1350 A - continued

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	3.35	5.95	4.91
Total linear shrinkage, percent	5.73	8.33	7.29
Fired colors	Salmon	Salmon	Brown

Remarks: scummed, overfired at 2012°F
Suggested uses: structural clay products, drain tile, and flower pots.

SAMPLE R 214

NE¼ SW¼ SE¼ sec. 31, T. 6 N., R. 5 E. Sampled in 1931.
Sample from 13 feet of gray blocky shale, with scattered clay ironstone concretions. Age: Pennsylvanian - Carbondale Formation - Purington Shale.

Characteristics of Unfired Material

The material is a hard, sandy shale that is uniformly gray in color, has a stony fracture, poor plasticity over a short range, and requires 26.3 percent water to develop its normal, quite soft,working consistency. A low-medium bonding strength is indicated by a value of 168 pounds per square inch for the modulus of rupture.

It dries somewhat slowly but without difficulty under ordinary atmospheric conditions; scums slightly; and has a shrinkage of 5.1 percent.

When slaked and washed on a 40-mesh sieve, 8.9 percent residue remains; it consists of unslaked original material high in mica, and contains some iron sulfide minerals.

Treatment with hot hydrochloric acid causes mild evolution of gas, indicating the presence of carbonates.

When burned, the clay oxidizes without difficulty and has the vitrification characteristics indicated below.

Characteristics of Fired Material

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Linear shrinkage % Total
04	28.8	Salmon		3.2	8.3
01	20.2	Brown-red		6.4	11.5
1	17.7	Red	Steel hard	6.9	12.0
2	15.9	Red	Steel hard	7.6	12.7
4	7.8	Chocolate	Steel hard	9.5	14.6
6	0.4	Black	Steel hard	6.4	11.5

Remarks: this material vitrifies slowly until cone 2 is reached, then more rapidly. It overburns above cone 4 but not seriously at cone 6. The total shrinkages are medium. The most favorable range for color is from cone 01 to cone 4 inclusive, varying from brown-red to chocolate.
Suggested uses: common and face brick, if the soluble salts can be controlled; possibly paving brick and hollow ware.

GREENE COUNTY

SAMPLES R 113 and R 114

SW¼ NE¼ SE¼ sec. 15, T. 11 N., R. 13 W. Sampled in 1930. Age: Pennsylvanian - Spoon Formation.

		ft.
3.	Clay, gray, hard (sample 113)	4
2.	Clay, pink, red, and yellow	1
1.	Clay, white, sandy (sample 114)	2
	Covered	

GREENE COUNTY - continued

SAMPLE R 113

Characteristics of Unfired Material

Sample R 113 is a nearly white, medium hard, rather sandy material containing small lumps of a harder, smooth clay. When 17.6 percent of water is added, it develops a soft consistency and a rather poor plasticity of a limited range. When this plastic material is dried, it shows a linear shrinkage of 4 percent, and it dries rapidly without defects under ordinary laboratory room conditions. It has a low-medium bonding strength with a value of 153 pounds per square inch for the modulus of rupture.

When slaked and washed on a 40-mesh sieve, a residue of 77 percent is obtained, which under the magnifying glass appears to be quartz grains bonded with a white clay.

When burned, no special oxidation treatment is required.

Characteristics of Fired Material

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Linear shrinkage % Total
05	32	White	Scratched by steel	1	5
01	32	White	Scratched by steel	1	5
1	30	White	Scratched by steel	1	5
2	31	White	Scratched by steel	1	5
3	29	White	Scratched by steel	2	6
6	29	White	Scratched by steel	2	6
8	29	White	Scratched by steel	2	6
9	28	White	Scratched by steel	2	7
11	27	White	Scratched by steel	3	7
14	26	Cream	Scratched by steel	3	7

Remarks: fusion test gave a PCE value of 30½. This clay burns with little change in porosity, shrinkage, or color throughout a wide range of temperatures.
Suggested uses: suited to manufacture of a variety of refractory products.

SAMPLE R 114

Characteristics of Unfired Material

Sample R 114 is a hard clay having a nearly white color and a stony fracture. When 19.5 percent of water is added, the mass shows a fair degree and range of plasticity. When exposed to ordinary room temperature the plastic mass dries safely with a shrinkage of 5.5 percent. It has a low bonding strength with a value of 47.5 pounds per square inch for the modulus of rupture.

When slaked with water and washed through a 40-mesh sieve a residue of 8 percent remains. This consists chiefly of fine quartz sand grains as well as quartz grains bonded with a white material. Further screen analysis gives the following: 48-mesh - 10.7 percent; 65-mesh - 9.6 percent; 100-mesh - 12.0 percent; and through 100-mesh - 67.7 percent.

The clay reacts faintly with hydrochloric acid indicating the probable presence of small amounts of carbonates.

When burned, the clay does not require any special oxidation treatment.

Characteristics of Fired Material

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Linear shrinkage % Total
05	28.7	White		0.9	6.4
01	28.1	White		1.0	6.5

GREENE COUNTY - continued

SAMPLE R 114 - continued

Characteristics of Fired Material - continued

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Total
1	27.7	White		1.3	6.8
2	27.8	White		1.2	6.7
3	27.2	White		1.5	7.0
6	27.4	White		1.7	7.2
8	25.5	Cream		2.1	7.6
9	24.6	Cream		2.7	8.2
11	23.9	Tan		2.9	8.4
14	17.8	Tan	Steel hard	4.2	9.7

Remarks: the clay is refractory as its PCE is between cones 29 and 30. It is an open-burning material having only a slight change of porosity over a wide temperature range. Its total shrinkages are very low and show only a small increase throughout a wide range of temperature. The color of the burned clay is nearly white up to cone 6, after that it develops a cream which becomes a tan.
Suggested uses: manufacture of refractories, certain kinds of sanitary ware, architectural terra cotta, face brick.

SAMPLES BELL 1 and 3

NW¼ SE¼ SE¼ sec. 5, T. 12 N., R. 11 W. Sampled about 1930 (A. H. Bell, personal communication).

	ft.	in.
Pleistocene		
8. Soil and till	4	
7. Clay, greenish		4
Pennsylvanian - Carbondale Formation		
6. Limestone, yellow, earthy		4
5. Clay, yellow and green	1	4
4. Clay, carbonaceous, dark gray		6
3. Clay, gray, nonbedded (sample Bell 3)	8	
2. Limestone, with irregular nodules and druses of calcite	2	
1. Shale, silty, yellowish gray, finely laminated (sample Bell 1)	6	
Covered		

SAMPLE BELL 1

Characteristics of Unfired Material

The material is a shale that contains concretions, is very light tan in color, has an irregular hackly fracture, good plasticity over a satisfactory range, and requires 28.8 percent water to develop its normal, medium-soft,working consistency. A medium bonding strength is indicated by a value of 237 pounds per square inch for the modulus of rupture.

It dries somewhat slowly under ordinary atmospheric conditions,with some cracking, and has a shrinkage of 6.8 percent.

When slaked and washed on a 40-mesh sieve, 7.9 percent residue remains,which consists of some large, brown, "sandstone-like" particles, considerable quartz, some gray lumps high in mica, and a few particles which appear to be red iron crystalline formations bonded with a gray substance.

Treatment with cold hydrochloric acid causes moderate evolution of gas, indicating the presence of carbonates.

When burned, the clay oxidizes readily.

GREENE COUNTY - continued

SAMPLE BELL 1 - continued

Characteristics of Fired Material

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Linear shrinkage % Total
06	28.2	Salmon		3.7	10.5
02	19.7	Light red	Steel hard	6.6	13.4
01	18.3	Light red	Steel hard	6.8	13.6
2	5.8	Dark brownish red	Steel hard	9.1	15.9
4	0.3	Chocolate	Steel hard	9.7	16.5
6	11.6		Steel hard	3.9	10.7

Remarks: the material vitrifies rapidly and is overburned between cones 4 and 6. The rate of burning shrinkage increases rapidly between cone 01 and 2, and the total shrinkage is high. The color changes decidedly from cone 02 to cone 4.
Suggested uses: hollow ware and common brick.

SAMPLE BELL 3

Characteristics of Unfired Material

The material is a stoneware type of clay, mottled gray and tan in color, has a hackly fracture, is slightly soapy, has very sticky plasticity over a wide range, and requires 35.8 percent water to develop its normal medium-stiff working consistency. A medium bonding strength is indicated by a modulus of rupture of 393 pounds per square inch.

It dries slowly under ordinary atmospheric conditions without difficulty, scums slightly, and has a shrinkage of 14.0 percent.

When slaked and washed on a 40-mesh sieve, 1.0 percent residue remains which consists of quartz grains, a few red stony particles, and a few larger brown fragments, probably limestone. Further screen analysis of the material showed 0.1 percent residue on 48-mesh, 1.6 percent of 65-mesh, 3.5 percent on 100-mesh, and 94.8 percent through 100-mesh.

Treatment with cold hydrochloric acid causes mild evolution of gas indicating the presence of carbonates.

When burned, the clay oxidizes readily.

Characteristics of Fired Material

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Linear shrinkage % Total
05	13.3	Pale brown to tan	Steel hard	6.1	20.1
02	4.3	Pale brown to tan	Steel hard	6.9	20.9
01	5.5	Pale brown to tan	Steel hard	6.8	20.8
2	1.2	Pale brown to tan	Steel hard	7.3	21.3
3	0.4	Pale brown to tan	Steel hard	7.5	21.5
6	0.9	Bluestone	Steel hard	7.4	21.4
8	0.4	Bluestone	Steel hard	7.3	21.3
9	23.2	Stoneware gray	Steel hard	12.2	26.2
11	21.9	Dark gray	Steel hard	0.9	13.1

Remarks: the material vitrified gradually above cone 05 and has a long range as it does not overburn until cone 8 is passed. It has a PCE value of cone 18. The burning shrinkage is practically constant up to the latter cone. There are indications of soluble salts present.
Suggested uses: fireproofing and hollow ware; also, if soluble salts can be corrected, face brick, tile, architectural terra cotta, and stoneware.

GREENE COUNTY - continued

SAMPLE 1355 A

SE¼ NW¼ sec. 30, T. 12 N., R. 11 W. Two and one-half miles northeast of Whitehall.

About 15 feet of brownish yellow shale, overburden 15 to 20 feet.

Material: shale
Water of plasticity, percent 30
Linear drying shrinkage, percent 4.50
Age: Pennsylvanian - Carbondale Formation - Francis Creek Shale
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	6.96	7.48	4.35
Total linear shrinkage, percent	11.46	11.98	8.85
Fired colors	Salmon	Salmon	Red

Remarks: overburned at 2012°F
Suggested uses: structural clay products, drain tile, sewer pipe, and flower pots.

GRUNDY COUNTY

SAMPLES 1331 A and 1331 F

SW¼ SW¼ sec. 12, T. 31 N., R. 8 E. East of East Brooklyn, pit of Northern Illinois Coal Corporation.

Ten feet of blue-gray shale above No. 7 Coal.

Material: shale
Water of plasticity, percent 26
Linear drying shrinkage, percent 4.42
Age: Pennsylvanian - Modesto Formation - Farmington Shale
Workability: fair

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	6.51	8.60	7.04
Total linear shrinkage, percent	10.93	13.02	11.46
Fired colors	Salmon	Red	Red

Remarks: overburned at 2012°F
Suggested uses: sewer pipe and structural clay products.

SAMPLE 1331 B

Same location as above.

Blue-gray siltstone 5 feet, and 5 feet of blue-gray clay, calcareous, above sample 1331 A.

Material: siltstone and clay
Water of plasticity, percent 25
Linear drying shrinkage, percent 6.25
Age: Pennsylvanian - Modesto Formation
Workability: fair

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	0.00	1.04	1.56
Total linear shrinkage, percent	6.25	7.29	7.81
Fired colors	Salmon	Salmon	Dirty red

Remarks: contains lime
Suggested uses: common brick, building tile, and drain tile.

SAMPLE 1331 C

Same location as sample 1331 A.

Five feet of underclay and shale above siltstone and clay.

G R U N D Y C O U N T Y - continued

SAMPLE 1331 C - continued

Material: underclay and shale
Water of plasticity, percent 26
Linear drying shrinkage, percent 6.77
Age: Pennsylvanian - Modesto Formation
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	0.52	1.04	0.00
Total linear shrinkage, percent	7.29	7.81	6.77
Fired colors	Red-brown	Red-brown	Red-brown

Remarks: overfired at 2012°F; color not desirable for face brick
Suggested uses: common brick, drain tile, building tile, and sewerpipe.

SAMPLE 1401

SW¼ sec. 11, T. 33 N., R. 6 E. Morris Clay Company pit, about 4 miles west of Morris.

Upper 20 feet of brownish gray, sandy shale.

Material: shale
Water of plasticity, percent 16
Linear drying shrinkage, percent 2.08
Age: Pennsylvanian - Carbondale Formation - Francis Creek Shale
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	1.56	7.29	7.81
Total linear shrinkage, percent	3.64	9.37	9.89
Fired colors	Salmon	Salmon	Red

Suggested uses: structural clay products, drain tile, and flower pots.

H A N C O C K C O U N T Y

SAMPLE 1408

SW¼ SW¼ sec. 26, T. 3 N., R. 5 W. Southeast bank of Williams Creek, about 200 yards southeast of Augusta-Clayton road about 2 miles south of Augusta.

About 30 feet of gray shale exposed, overburden about 30 feet.

Material: shale
Water of plasticity, percent 24
Linear drying shrinkage, percent 2.60
Age: Pennsylvanian - Carbondale Formation - Francis Creek Shale
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	1.57	5.21	3.65
Total linear shrinkage, percent	4.17	7.81	6.25
Fired colors	Salmon	Salmon	Red

Remarks: scummed; overfired at 2012°F
Suggested uses: drain tile, and structural clay products if soluble salts could be controlled.

J A C K S O N C O U N T Y

SAMPLE 1336 A

NW¼ SW¼ NW¼ sec. 10, T. 9 S., R. 2 W. West bank of ravine about 200 yards upstream from mine.

About 16 feet medium gray to brownish gray, poorly to well bedded, silty shale, with spheroidal weathering and plant traces.

JACKSON COUNTY - continued

SAMPLE 1336 A - continued

Material: shale — Age: Pennsylvanian - Spoon Formation
Water of plasticity, percent 19 — Workability: fair
Linear drying shrinkage, percent 2.08

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	3.65	5.73	7.81
Total linear shrinkage, percent	5.73	7.81	9.89
Fired colors	Salmon	Red	Red

Suggested uses: structural clay products, drain tile, and flower pots.

SAMPLE 1336 B

SE¼ NE¼ NE¼ sec. 18, T. 9 S., R. 2 W. Southwest cut bank of creek just west of first bridge on north-south section line road.

Bottom 8 feet of 35-foot shale section; shale, hard, medium gray, silty, very poorly bedded, semi-conchoidal fracture, lower 2 feet becomes better bedded and carbonaceous.

Material: shale — Age: Pennsylvanian - Abbott Formation
Water of plasticity, percent 15 — Workability: good
Linear drying shrinkage, percent 2.08

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	3.65	5.73	6.77
Total linear shrinkage, percent	5.73	7.81	8.85
Fired colors	Chocolate	Red	Red

Suggested uses: structural clay products, drain tile, and flower pots.

JASPER COUNTY

SAMPLE 1411

SE¼ SE¼ SE¼ sec. 35, T. 7 N., R. 9 E. Northwest edge of Newton on east cut bank of tributary to Embarrass River.

About 10 feet of shale exposed; shale, sandy, blue-gray, and laminated.

Material: shale — Age: Pennsylvanian - Mattoon Formation
Water of plasticity, percent 22 — Workability: fair
Linear drying shrinkage, percent 2.60

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	2.61	4.17	8.86
Total linear shrinkage, percent	5.21	6.77	11.46
Fired colors	Salmon	Salmon	Red

Remarks: overfired at 2012°F
Suggested uses: structural clay products, drain tile, flower pots, and sewerpipe.

KANE COUNTY

SAMPLE NF 150

SE¼ NW¼ NW¼ sec. 24, T. 42 N., R. 7 E. Section exposed in an abandoned clay pit. Sampled in 1933.

KANE COUNTY - continued

SAMPLE NF 150 - continued

	ft.	in.
Pleistocene		
Wisconsinan		
3. Soil, black	1	2
2. Clay, upper part gray, lower part yellow, noncalcareous, grades into bed below (sample NF 150)	2	6
1. Clay, light yellow, calcareous		6+

Bed 2 is a lake clay deposited in ancient Gilberts Lake.

Characteristics of Unfired Material

Material: clay
Reaction for carbonates: negative
Color: yellow with brown cast in part of sample
Hardness: medium; granular fracture
Working properties: wedges easily and quickly; slightly sticky
Water of plasticity, percent: 33.3
Modulus of rupture, with 50 percent standard sand: 470 lbs. per sq. in.- 13 specimens

Fineness

Residue, percent: 35-mesh - 2.72
Character of residue: small limonite grains

Drying

Air shrinkage, percent: linear 12.8 volume 43.6
Drying conduct: satisfactory
Scumming: none

Characteristics of Fired Material

Cone	Porosity %	Color	Hardness	Burning shrinkage % Linear	Burning shrinkage % Volume	Total shrinkage % Linear	Total shrinkage % Volume
06	25.9	Salmon	3	0.3	0.8	13.1	44.4
03	19.1	Red	5	3.2	9.4	16.0	53.0
01	12.4	Red	5-6	5.5	15.7	18.3	59.3
3	3.7	Light maroon	6	6.6	18.6	19.4	62.2
4	1.8	Maroon	7	5.7	16.2	18.5	59.8
6	0.6	Maroon	8	5.6	15.8	18.4	59.4
8	6.3	Deep maroon	8	0.3	0.8	13.1	44.4

Remarks: the sample, at cone 4, reoxidized after reduction in firing, and, at cone 8, was bloated and sticky. It is readily made plastic although it is slightly sticky. It dries satisfactorily and has better than average strength. The burning conduct is satisfactory inasmuch as it has a range of probably four or five cones of low porosity. The color of the burned ware is good, and the range of colors is very good.
Suggested uses: common and face brick, drain tile, quarry tile, roofing tile, and structural tile.

KANKAKEE COUNTY

SAMPLE 1324B

NW¼ NE¼ sec. 8, T. 31 N., R. 9 E. Pit 11 of Northern Illinois Coal Corporation.

Lower 10 feet of shale.

K A N K A K E E C O U N T Y - continued

SAMPLE 1324B - continued

Material: shale
Water of plasticity, percent 22
Linear drying shrinkage, percent 2.34
Age: Pennsylvanian - Carbondale Formation - Francis Creek Shale
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	2.87	7.03	9.12
Total linear shrinkage, percent	5.21	9.37	11.46
Fired colors	Chocolate	Chocolate	Chocolate

Suggested uses: structural clay products, drain tile, and flower pots.

SAMPLE 1324D

Same location as sample 1324B. Upper 10 feet of shale.

Material: shale
Water of plasticity, percent 18
Linear drying shrinkage, percent 2.08
Age: Pennsylvanian - Carbondale Formation - Francis Creek Shale
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	2.09	4.69	6.77
Total linear shrinkage, percent	4.17	6.77	8.85
Fired colors	Salmon	Salmon	Red

Suggested uses: structural clay products, drain tile, and flower pots.

K N O X C O U N T Y

SAMPLES NF 363A and NF 364

Center E½ SE¼ NW¼ sec. 6, T. 9 N., R. 2 E. Sampled in 1935.

The following strata were exposed along a north-south road:

	ft.
Pleistocene	
6. Till and loess	11
Pennsylvanian - Carbondale Formation	
5. Shale, gray to brown with ironstone concretions	5
4. Shale, black	2
3. Shale, gray to brown, thin-bedded (sample NF 364, but sampled in a small coal pit about 100 feet west of the road where the shale is 7½ feet thick)	5
2. Coal (Colchester No. 2 Coal)	2
Pennsylvanian - Spoon Formation	
1. Clay, noncalcareous, gray, much brown staining, becomes shaly in basal 6 inches (sample NF 363A)	7½
Covered	

SAMPLE NF 363A

Characteristics of Unfired Material

Color: yellowish gray
Fracture: variable; part retains the fissile structure; other portions weathered so that fissile structure is invisible
Reaction for pyrite: negative
Drying conduct: satisfactory
Hardness: variable; some shattered between the fingers; some too hard to permit this
Reaction for carbonates: cold - trace
Soluble salts: no scumming
Working properties: very good; a little fat

KNOX COUNTY - continued

SAMPLE NF 363A - continued

Drying shrinkage, percent: linear 9.3; volume 30.5
Screen test: residue on 35-mesh sieve - 33 percent; limonite exists as concretionary lenses, crusts, stringers, and as a bond cementing grains of silica and clay. These concretions are apparently siliceous particles, quite soft and friable, bonded with limonite.

Characteristics of Fired Material

Cone	Absorption %	Porosity %	Color	Hardness	Burning shrinkage % Linear	Burning shrinkage % Volume	Remarks
06	9.7	19.7	Light red	6	9.9	22.0	No scum
04	0.1	0.2	Dark red	8	14.0	36.4	Fine, glossy red color
02	0.1	0.2	Dark red	8	14.0	36.4	Fine, glossy red color
4	0.3	0.6	Dark red	8	7.2	20.0	Overburned

Oxidation conduct: requires slightly prolonged oxidation treatment at temperatures lower than normal
Suggested uses: the fine color, together with the low maturing temperature and the long vitrification range make this a desirable material for the manufacture of face brick. It should be noticed that this clay develops a hardness of 7 at cone 06, which is very unusual. This clay would produce either vitrified or non-vitrified ware at temperatures lower than usual.

SAMPLE NF 364

Characteristics of Unfired Material

Color: gray, often with yellow surface coating
Hardness: most too hard to shatter with the fingers
Fracture: most breaks into flakes, characteristic of fissile structure
Reaction for carbonates: cold - negative
hot - negative
Reaction for pyrite: negative
Soluble salts: sulfates negative
Working properties: excellent
Drying shrinkage, percent: linear 7.6
volume 24.5
Drying conduct: no difficulty noted

Screen test: residue on 35-mesh sieve - 7.7 percent. Stringers, crusts, and concretions of siliceous material bonded with limonite. These are soft and readily disintegrated.

Characteristics of Fired Material

Cone	Absorption %	Porosity %	Color	Hardness	Burning shrinkage % Linear	Burning shrinkage % Volume	Remarks
06	14.3	27.0	Light red	5	4.4	12.6	Clear, uniform surface
1	5.6	12.4	Bright red	7	9.4	25.7	Clear, uniform surface
5	0.15	0.3	Brownish red	8-9	10.3	27.8	Clear, uniform surface

Oxidation conduct: not difficult to oxidize, but should be oxidized at a lower temperature than usual

KNOX COUNTY - continued

SAMPLE NF 364 - continued

Warpage: none noted
Remarks: matures at a low temperature, has a long firing range, and can be vitrified
Suggested uses: face brick, sewer pipe, paving brick, building tile, conduits, roofing tile, drain tile, common brick, and art pottery.

SAMPLES NF 365, NF 366, and NF 367

SE¼ NW¼ NE¼ sec. 6, T. 9 N., R. 2 E. Sampled in 1935.
Composite section of strata exposed on the west side of Brush Creek south of the road.

	ft.	in.
Covered, probably about 30 feet of bedrock, including Colchester No. 2 Coal, and 10 to 20 feet of loess and till	40-50	
Pennsylvanian - Spoon Formation		
9. Sandstone, fine-grained	8±	
8. Shale, gray and brown	2	6
7. Coal (Wiley Coal?)		8-12
6. Fireclay, gray and brown (sample NF 367)	4	
5. Coal		2-4
4. Fireclay, gray to dark gray (sample NF 366)	5	6
3. Sandstone, quartzitic, fine-grained	1-2½	
2. Clay, sandy white and yellow with a 4-inch bed of soft sandstone near base; grades into bed below (sample NF 365)	4	
1. Sandstone	2	6
Covered		

SAMPLE NF 365

Characteristics of Unfired Material

Color: gray
Hardness: crushable between the fingers
Reaction for carbonates: cold - negative
hot - trace
Reaction for pyrite: trace
Soluble salts: soluble iron compound
Working properties: very good - somewhat short
Drying shrinkage, percent: linear 5.2
volume 16.5
Drying conduct: excellent
Screen test: residue on 35-mesh sieve - 0.1 percent. Silica sand; clay contains considerable gritty material which passes this screen

Characteristics of Fired Material

Cone	Absorption %	Porosity %	Color	Hardness	Burning shrinkage % Linear	Volume	Remarks
06	15.5	28.4	Pinkish yellow	2½	0.3	0.9	
1	15.0	28.1	Yellow	3	1.3	3.8	Red surface scum
6	10.6	21.4	Buff	7	3.6	10.5	Traces of pink

Oxidation conduct: no oxidation problem
Warpage: none
Suggested uses: drain tile, common brick, or buff face brick. May have some possible uses as a low-grade refractory. Could be colored readily by mixing a little red-burning clay, as it forms good red colors readily in the presence of iron compounds.

KNOX COUNTY - continued

SAMPLE NF 366

Characteristics of Unfired Material

Color: light gray mixed with some dark gray
Hardness: readily friable
Fracture: granular
Reaction for carbonates: cold - negative
hot - negative
Reaction for pyrite: present
Working properties: excellent
Drying shrinkage, percent: linear 7.6
volume 24.5
Drying conduct: excellent
Screen test: residue on 35-mesh sieve - 0.5 percent. Sandstone, coal, and limonite; small amount of pyrite

Characteristics of Fired Material

Cone	Absorption %	Porosity %	Color	Hardness	Burning shrinkage % Linear	Volume
06	16.1	29.0	Light pink	3	1.0	3.2
1	6.2	13.4	Pinkish buff	7	7.1	19.7
2	4.0	8.6	Buff	8	7.2	20.1
3	3.7	8.4	Buff	9	9.0	24.6
6	0.4	0.8	Buff	9	9.1	25.0

Oxidation conduct: requires reasonable oxidation period
Suggested uses: typical terra cotta clay; would make good buff face brick; could be used for conduits and stoneware.

SAMPLE NF 367

Characteristics of Unfired Material

Color: greenish gray
Hardness: 3
Fracture: poor, fissile
Reaction for carbonates: cold - present
hot - negative
Reaction for pyrite: abundant
Soluble salts: sulfates present
Working properties: fair, a fat clay; tends to laminate
Drying shrinkage, percent: linear 12.5
volume 42.2
Drying conduct: likely to crack unless carefully dried
Screen test: residue on 35-mesh screen - 0.65 percent; probably 85 percent pyrite; remainder is coal, calcite, and gypsum

Characteristics of Fired Material

Cone	Absorption %	Porosity %	Color	Hardness	Burning shrinkage % Linear	Volume	Remarks
06	8.9	18.1	Salmon pink	7	4.7	13.5	No scum
04	0.5	1.0	Dark buff	9	8.0	22.2	Some scum
6	25.0	32.8	Light buff	7	12.9	34.4	Overfired; bloated uniformly and swelled 34.4 percent of dry volume; maintained square edges

KNOX COUNTY - continued

SAMPLE NF 367 - continued

Oxidation conduct: very difficult to oxidize; oxidation must be carried out around 900°F or bloating occurs
Soluble salts: sulfates present
Suggested uses: the uniform swelling of this clay when overfired suggests usefulness as an ingredient in ladle brick. However, this action may occur at too low a temperature, and this would have to be checked. The ease, the completeness, and the low temperature of bloating of this clay when not properly oxidized would make it a useful material for the production of "Haydite". The high degree of hardness achieved at the extraordinarily low maturing temperature would make it useful for face brick, hollow tile, and perhaps roofing tile.

SAMPLE NF 368

S½ N½ SW¼ sec. 25, T. 11 N., R. 1 E. Sampled in 1935.

Exposure in small gully west of barn:	ft.	in.
Pennsylvanian - Carbondale Formation		
6. Shale, slaty	3	
5. Coal (Springfield No. 5 Coal)	2	
4. Shale, gray and yellow-brown		10
3. Shale, yellow-brown		10
2. Shale, dark gray with thin, cream-colored partings	2	
1. Limestone, fine-grained		8
Covered		

Sample NF 368 is from the shale comprising beds 2, 3, and 4.

Characteristics of Unfired Material

Color: gray; portions darker gray; some yellow surface coating
Hardness: 1; some fissile, some granular
Reaction for carbonates: cold - positive; hot - negative
Reaction for pyrite: trace
Screen test: residue on 35-mesh screen - 3.5 percent. Limestone, gypsum, coal, and root casts
Working properties: fair - somewhat fat
Soluble salts: present
Drying shrinkage, percent: linear 12.5, volume 42.5
Drying conduct: must be dried slowly to prevent cracking

Characteristics of Fired Material

Cone	Absorption %	Porosity %	Color	Hardness	Burning shrinkage % Linear	Burning shrinkage % Volume	Remarks
06	8.5	17.8	Light red	6	4.2	12.1	Heavy scum
04	6.2	13.1	Dark red	7	6.6	18.5	Heavy scum
6	9.6	14.0	Chocolate	8	7.8	21.8	Bloated

Oxidation conduct: requires somewhat prolonged oxidation period at lower temperatures
Suggested uses: common brick, face brick, hollow tile, and drain tile.

SAMPLE 1347 A

SE¼ sec. 17, T. 11 N., R. 2 E. Purington Brick Company pit southeast of East Galesburg.

Approximately 20 feet of gray shale exposed.

KNOX COUNTY - continued

SAMPLE 1347 A - continued

Material: shale
Water of plasticity, percent 22
Linear drying shrinkage, percent 2.60
Age: Pennsylvanian - Carbondale Formation - Purington Shale
Workability: good

Fired temperatures	1832°F	1922°F
Linear fired shrinkage, percent	1.57	3.65
Total linear shrinkage, percent	4.17	6.25
Fired colors	Salmon	Salmon

Suggested uses: structural clay products, drain tile, and flower pots.

LA SALLE COUNTY

SAMPLES W 7 and W 8

SE¼ SE¼ NW¼ sec. 14, T. 33 N., R. 1 E. In pit of Alpha Portland Cement Company. Sampled in 1931.

	ft.	in.
Pennsylvanian - Mattoon Formation		
7. Clay, red (sample W 8)	5	
6. Shale, red, with 1-to 2-inch layers of green shale	2½-3	
5. Shale, red, gray splotches, locally contains limestone concretions and fossils (sample W 7)	8	
4. Clay, gray	1	
3. Limestone, lenticular		8
2. Covered	5	
Pennsylvanian - Bond Formation		
1. Limestone (LaSalle Limestone)		

SAMPLE W 7

Characteristics of Unfired Material

The material is a hard, sandy shale, purplish red in color, has a stony fracture, medium plasticity over a fair range, and requires 28.4 percent water to develop its normal medium-soft, oily working consistency. A low-medium bonding strength is indicated by 190 pounds per square inch for the modulus of rupture.

It dries slowly under ordinary atmospheric conditions, scums slightly, and has a shrinkage of 7.2 percent.

When slaked and washed on a 40-mesh sieve, 38.6 percent residue remains which consists of unslaked original material and small mica flakes and quartz grains which are probably bonded together with lime.

Treatment with cold hydrochloric acid causes generous evolution of gas, indicating the presence of carbonates.

When burned, the clay oxidizes readily.

Characteristics of Fired Material

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Linear shrinkage % Total
04	1.0	Medium dark red	Steel hard	10.5	17.7
02	0.4	Medium dark red		10.6	17.8
01	0.3	Medium dark red		10.5	17.7
3	0.2	Darker red		8.6	15.8
4	0.7			5.2	12.4
6	8.1	Metallic, swelled		3.4	10.6

LA SALLE COUNTY - continued

SAMPLE W 7 - continued

Remarks: this material is vitrified at cone 04 and practically nonabsorbent. It begins to overburn above cone 01 and is badly overburned at cone 6. The shrinkage is medium. The medium dark red color is reasonably uniform from cone 04 to cone 3.

Suggested uses: sewer brick, quarry tile, roof and floor tile, hollow ware - unless the soluble salts are too troublesome.

SAMPLE W 8

Characteristics of Unfired Material

The material is a clay of purplish red color with gray mottling, has an irregular hackly fracture, and requires 33.3 percent water to develop its normal good working consistency. A low-medium bonding strength is indicated by the value of 182 pounds per square inch for the modulus of rupture.

It dries slowly under ordinary atmospheric conditions, scums somewhat, and has a shrinkage of 11.6 percent.

When slaked and washed on a 40-mesh sieve, 3.4 percent residue remains, consisting of red lumps with varying concentration of mica and a few lumps of quartz grains bonded with calcium carbonate.

Treatment with cold hydrochloric acid causes violent evolution of gas, indicating the presence of carbonates.

When burned, the clay oxidizes readily.

Characteristics of Fired Material

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Linear shrinkage % Total
04	18.2	Red	Steel hard	5.4	17.1
02	13.8 (?)	Red	Steel hard	6.0	17.7
01	18.7	Red	Steel hard	3.3	15.0
1	0.9	Darker red	Steel hard	7.0	18.7
3	0.5	Overburned		4.9	16.6
6	Slagged				

Remarks: the clay has a good red color and considerable porosity up to and including cone 01. Its total shrinkage is high. Above the temperature mentioned, it vitrifies rapidly, overburns at cone 3, and is completely fused at cone 6.

Suggested use: common brick.

SAMPLE 1324 A

SW¼ SW¼ sec. 5, T. 33 N., R. 4 E. Laclede Christy Division, H. K. Porter Company pit, 1½ miles east of Ottawa, north of U. S. Highway 6, east of Illinois Highway 71.

Lower 10 feet of blue-gray, clayey shale.

Material: shale
Water of plasticity, percent 27
Linear drying shrinkage, percent 3.90
Age: Pennsylvanian - Carbondale Formation - Francis Creek Shale
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear firing shrinkage, percent	4.75	8.60	9.12
Total linear shrinkage, percent	8.85	12.50	13.02
Fired colors	Chocolate	Chocolate	Chocolate

Suggested uses: drain tile, sewerpipe, and building tile and block.

L A SALLE C O U N T Y - continued

SAMPLE 1324 C

Same location as sample 1324 A.
Upper 10 feet of shale, which contains more sand and silt.

Material: shale
Water of plasticity, percent 20
Linear drying shrinkage, percent 2.60
Age: Pennsylvanian - Carbondale Formation - Francis Creek Shale
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	2.08	4.69	7.29
Total linear shrinkage, percent	4.68	7.29	9.89
Fired colors	Chocolate	Chocolate	Chocolate

Suggested uses: drain tile, sewerpipe, and building block and tile.

SAMPLE 1403

SW¼ SW¼ SW¼ sec. 9, T. 33 N., R. 3 E. Pit of Illinois Valley Mineral Company, 1½ miles west of Ottawa along north bluff of Illinois River.
Approximately 8 feet of blue-gray shale above Colchester (No. 2) Coal.

Material: shale
Water of plasticity, percent 25
Linear drying shrinkage, percent 3.12
Age: Pennsylvanian - Carbondale Formation - Francis Creek Shale
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	4.17	4.73	2.08
Total linear shrinkage, percent	7.29	8.85	1.04
Fired colors	Light salmon	Light salmon	

Remarks: considerably overfired at 2012°F; pyrite
Suggested use: drain tile.

L A W R E N C E C O U N T Y

SAMPLE 1426

SE¼ SW¼ NW¼ sec. 5, T. 3 N., R. 11 W. East cut bank of Embarrass River, north of U. S. Highway 50.
Upper 10 feet of shale bank 30 to 40 feet in height, overburden 10 to 15 feet; shale, brownish gray, weathered.

Material: shale
Water of plasticity, percent 20
Linear drying shrinkage, percent 2.08
Age: Pennsylvanian - Bond Formation
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	2.60	3.13	8.34
Total linear shrinkage, percent	4.68	5.21	10.42
Fired colors	Salmon	Salmon	Red

Suggested uses: structural clay products, drain tile, and flower pots.

L I V I N G S T O N C O U N T Y

SAMPLE 1321 A

SW¼ SW¼ sec. 34, T. 27 N., R. 8 E. Diller Brick and Tile Company pit north of Chatsworth.
Approximately 15 feet of blue-gray till.

LIVINGSTON COUNTY - continued

SAMPLE 1321 A - continued

Material: till
Water of plasticity, percent 21
Linear drying shrinkage, percent 3.38
Age: Pleistocene - Wisconsinan - Chatsworth
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	0.79	0.79	4.95
Total linear shrinkage, percent	4.17	4.17	8.33
Fired colors	Chocolate	Chocolate	Chocolate

Suggested uses: common brick, drain tile, and building tile and block.

MACOUPIN COUNTY

SAMPLE 1407

NE¼ NW¼ NE¼ sec. 9, T. 9 N., R. 7 W. South cut bank of Honey Creek south of road.

Approximately 15 feet of sandy shale exposed, overburden thick.

Material: shale
Water of plasticity, percent 20
Linear drying shrinkage, percent 2.08
Age: Pennsylvanian - Modesto Formation
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	3.13	3.13	8.91
Total linear shrinkage, percent	5.21	5.21	10.99
Fired colors	Salmon	Salmon	Red

Suggested uses: structural clay products, drain tile, and flower pots.

MADISON COUNTY

SAMPLE 1344 A

SE¼ SE¼ NE¼ sec. 35, T. 6 N., R. 10 W. Alton Brick Company pit east of road south of Coal Creek, north of Alton.

Lower 10 feet of dark gray shale.

Material: shale
Water of plasticity, percent 18
Linear drying shrinkage, percent 1.04
Age: Pennsylvanian - Carbondale Formation - Francis Creek Shale
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	1.56	3.65	7.29
Total linear shrinkage, percent	2.60	4.69	8.33
Fired colors	Salmon	Salmon	Red

Suggested uses: structural clay products, drain tile, and flower pots.

MARSHALL COUNTY

SAMPLE W 141

SW¼ NE¼ SE¼ sec. 16, T. 12 N., R. 9 E.

The following bedrock strata were exposed along Gimlet Creek above and below the road:

MARSHALL COUNTY - continued

SAMPLE W 141 - continued

Pennsylvanian - Modesto Formation	ft.	in.
7. Limestone, nodular, gray, dense, weathered light gray to white	5	3
6. Shale, dark gray and dark red	5	4
5. Limestone, dense, gray		6
4. Shale, gray with red streaks	9	
3. Limestone, reddish brown, dense		6
2. Shale, greenish gray, sandy, micaceous (sample W 141)	4	6
1. Sandstone, greenish gray, generally thin-bedded	20-30	

Characteristics of Unfired Material

The material is a moderately hard, sandy shale, light gray in color, has a stony and conchoidal fracture, low (mealy) plasticity over a short range, and requires 23.9 percent water to develop its normal medium-soft working consistency. A medium-low bonding strength is indicated by a value of 133 pounds per square inch for the modulus of rupture.

It dries rather rapidly and without difficulty under ordinary atmospheric conditions, and has a shrinkage of 4.9 percent.

When slaked and washed on a 40-mesh sieve, 28.9 percent residue remains which consists of unslaked original material with a few small pyrite grains.

Treatment with hot and cold hydrochloric acid causes mild evolution of gas, indicating the presence of carbonates.

When burned, the clay oxidizes readily.

Characteristics of Fired Material

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Total
05	26.4	Salmon		2.8	7.7
01	15.4	Red	Steel hard	6.6	11.5
2	10.8	Red	Steel hard	8.0	12.9
3	9.6	Darker red	Steel hard	8.1	13.0
6	27.1	Overburned black	Steel hard	0.3	5.2

Remarks: this material vitrifies rapidly, reaching a minimum porosity above cone 3 and overburning seriously at cone 6. The total shrinkages are medium and high medium. The color is a good red which darkens rapidly.
Suggested uses: common brick.

SAMPLE NF 215

SW¼ NE¼ SE¼ sec. 16, T. 12 N., R. 9 E. Sampled in 1934.

Beds exposed are as follows:	ft.	in.
Pennsylvanian - Modesto Formation		
5. Limestone, nodular, gray (Lonsdale Limestone)	5	3
4. Shale, thin-bedded, dark gray	1	6
3. Shale, maroon or dark red, calcareous	2	
2. Shale, gray, calcareous	1	10
1. Limestone, shale, and sandstone Covered	26	2

Sample NF 215 is taken from beds 2, 3, and 4.

MARSHALL COUNTY - continued

SAMPLE NF 215 - continued

Characteristics of Unfired Material

Material: clay
Reaction for carbonates: positive
Color: dark mustard; small reddish particles with a yellow-gray background visible
Hardness: medium; laminated fracture
Working properties: wedges easily and quickly; slightly sticky

Fineness

Residue, percent: 35-mesh - 0.37
Character of residue: calcite

Drying

Air shrinkage, percent: linear 13.0, volume 44.3
Drying conduct: satisfactory
Scumming: trace

Characteristics of Fired Material

Cone	Absorption %	Color	Hardness	Remarks
06	6.9	Salmon	6	
02	5.3	Red	7	
4	1.6	Maroon	8	Black cored from reduction after previous oxidation; not overfired

Remarks: has fine color and range of color
Suggested uses: common brick, face brick, roofing tile, quarry tile, structural tile, and drain tile.

SAMPLE 1400

SE¼ NW¼ sec. 23, T. 12 N., R. 9 E. Roadcut west of Illinois Highway 29 between Hydraulic Press Brick plant and Sparland.

Lower 15 feet of weathered gray shale, overburden thick.

Material: shale
Water of plasticity, percent 22
Linear drying shrinkage, percent 1.04
Age: Pennsylvanian - Modesto Formation - Farmington Shale
Workability: fair

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	5.21	5.21	9.90
Total linear shrinkage, percent	6.25	6.25	10.94
Fired colors	Salmon	Salmon	Red

Suggested uses: structural clay products, drain tile, and flower pots.

SAMPLE W 43

SE¼ NW¼ NE¼ sec. 27, T. 12 N., R. 9 E. Sampled in 1930.

Bedrock exposed in cut bank of stream consists of:

		ft.	in.
Pennsylvanian - Modesto Formation			
6.	Shale, gray, thick bedded; contains small limestone concretions (Farmington Shale) (sample W 43)	15	
5.	Shale, soft, black, in distinct bedding		4
4.	Shale, gray, slaty, thin-bedded	1	6
3.	Coal, with ½-inch clay seam 8 inches above base (Danville No. 7 Coal)	3	5
2.	Fireclay	9	6
1.	Sandstone, massive, gray, calcareous, micaceous	6	
	Covered		

MARSHALL COUNTY - continued

SAMPLE W 43 - continued

Characteristics of Unfired Material

The material is a hard, dark bluish gray shale, has a slate-like fracture, has good plasticity over a moderate range, and requires 33.9 percent water to develop its normal medium-stiff working consistency.

It dries without difficulty but somewhat slowly under ordinary atmospheric conditions and has a shrinkage of 9.2 percent.

When slaked and washed on a 40-mesh sieve, 3.6 percent residue remains, consisting of unslaked original material and small agglomerations of pyrite crystals.

Treatment with cold and hot hydrochloric acid causes mild evolution of gas indicating the presence of carbonates.

When burned, the clay oxidizes with great difficulty.

Characteristics of Fired Material

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Total
06	5.0	Red		11.7	20.9
01	19.3	Red		8.0	1.2
1	10.0	Red		9.5	0.3
2	23.6	Red		15.8	6.6

Remarks: all test pieces cracked or swelled; this material overburned and bloated within the low temperature range studied

Suggested uses: common brick burned at lower temperatures or as a bloated aggregate at higher temperatures than cone 05.

MC DONOUGH COUNTY

SAMPLE 1325A

SE¼ NE¼ sec. 12, T. 5 N., R. 4 W. Colchester Brick and Tile Company pit, north edge of Colchester.

Lower 20 feet of shale above Colchester (No. 2) Coal.

Material: shale
Water of plasticity, percent 20
Linear drying shrinkage, percent 3.12
Age: Pennsylvanian - Carbondale Formation - Francis Creek Shale
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	2.61	5.73	7.30
Total linear shrinkage, percent	5.73	8.85	10.42
Fired colors	Salmon	Salmon	Red

Suggested uses: structural clay products, drain tile, and sewerpipe.

MENARD COUNTY

SAMPLE 1330 A

SW¼ SE¼ sec. 11, T. 18 N., R. 7 W. Springfield Clay Products Company pit north of Petersburg.

Approximately 35 feet of shale with 20 feet of overburden.

Material: shale
Water of plasticity, percent 23
Linear drying shrinkage, percent 3.38
Age: Pennsylvanian - Modesto Formation
Workability: good

MENARD COUNTY - continued

SAMPLE 1330 A - continued

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	3.91	8.60	9.12
Total linear shrinkage, percent	7.29	11.98	12.50
Fired colors	Salmon	Red	Red

Suggested uses: structural clay products, drain tile, and sewerpipe.

MERCER COUNTY

SAMPLE 1348A

SW¼ NW¼ sec. 8, T. 14 N., R. 2 W. Shale pit of Hydraulic Press Brick Company at Shale City.

Approximately 30 feet of blue-gray shale.

Material: shale
Water of plasticity, percent 24
Linear drying shrinkage, percent 1.56
Age: Pennsylvanian - Carbondale Formation - Francis Creek Shale

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	2.09	5.73	7.82
Total linear shrinkage, percent	3.65	7.29	9.38
Fired colors	Salmon	Salmon	Red

Remarks: overfired at 2012°F
Suggested uses: structural clay products, drain tile, and sewerpipe.

MONROE COUNTY

SAMPLE Z

N½ NW¼ NE¼ sec. 3, T. 2 S., R. 10 W. Sampled in 1932.

Exposure in drift of coal mine:	ft.	in.
Pennsylvanian - Carbondale Formation		
5. Limestone, dark gray, dense		8-12
4. Coaly clay or impure coal		3-5
3. Coal	1½-3	
2. Underclay, dark gray (sample Z)	3±	
1. Underclay, with limestone nodules		6±
Covered		

Characteristics of Unfired Material

Material: underclay
Color: gray
Hardness: 1 on Moh's scale
Working properties: packs badly when ground; works well in mold; has medium plasticity
Drying: air shrinkage, dry basis - linear 9.3 percent
Reaction for carbonates: yes
Reaction for pyrites: yes
Gypsum: present as fine particles

Characteristics of Fired Material

Cone	Color	Hardness	Linear shrinkage % Burning	Linear shrinkage % Total	Remarks
010	Buff		2.3	11.6	Bars have rough
07	Light brown	Steel hard	2.3	11.6	surface and are
01	Olive-drab		3.3	12.6	badly checked
3	Overburned				

MONROE COUNTY - continued

SAMPLE Z - continued

Remarks

Drying shrinkage: high-medium
Color range: variable
Vitrification: overburned at cone 3
Burning shrinkage: low-medium (cone 01)
Plasticity: medium

Suggested uses: common brick, hollow brick, face brick, glazed brick, enameled brick, and fireproofing.

MONTGOMERY COUNTY

SAMPLE 1412

NW¼ SW¼ sec. 30, T. 8 N., R. 2 W. One and one-half miles northeast of Coffeen on west bank of East Fork Creek.

Five to six feet of iron stained, gray shale, with plant fossils and coal band in middle of exposure.

Material: shale
Water of plasticity, percent 21
Linear drying shrinkage, percent 2.60
Age: Pennsylvanian - Bond Formation
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	3.65	5.21	2.61
Total linear shrinkage, percent	6.25	7.81	5.21
Fired colors	Salmon	Salmon	Red

Remarks: overfired at 2012°F
Suggested uses: structural clay products, drain tile, and flower pots.

PEORIA COUNTY

SAMPLE R 216

N½ SE¼ NE¼ sec. 26, T. 8 N., R. 7 E. Sample was taken from 9 feet of loess which is mostly brown and noncalcareous; lower 1 to 2 feet is gray and calcareous. Sampled in 1931. Age: Pleistocene - Wisconsinan - Peoria loess.

Characteristics of Unfired Material

The material is a yellow, surface clay, is a friable mixture of clayey loam and fine sand, has medium plasticity over a moderate range, and requires 25.6 percent water to develop its normal medium working consistency. Its bonding strength is high-medium with a value of 507 pounds per square inch.

It dries fairly rapidly and without difficulty under ordinary atmospheric conditions, scums slightly, and has a shrinkage of 5.5 percent.

When slaked and washed on a 40-mesh sieve, 0.6 percent residue remains that contains a few pyrite and silica grains but consists largely of brown and black slag-like particles that, because they are attacked by hydrochloric acid, are thought to be quartz bonded with hydrous iron oxide and/or carbonates of lime and iron. Treatment with hot hydrochloric acid causes generous evolution of gas, indicating the presence of carbonates. When burned, the clay oxidizes readily.

Characteristics of Fired Material

Cone	Porosity %		Hardness	Linear shrinkage % Burning	Total
04	33.1	Salmon		0.4	5.9
02	23.3	Red		4.2	9.7
1	15.8	Deep red	Steel hard	6.5	12.0
3	4.2	Deep red	Steel hard	8.5	14.0
6	Practically fused				

PEORIA COUNTY - continued

SAMPLE R 216 - continued

Remarks: this clay vitrifies to a low porosity at cone 3, and is overburned between that point and cone 6. It has a good red color between cones 02 and 3, and possibly somewhat higher. The total shrinkages are medium, except at cone 3, which is high-medium. The oxidation conduct is good.
Suggested uses: face and common brick, sewer brick, hollow ware, tile, and fireproofing.

SAMPLE 1402

SE¼ NW¼ sec. 13, T. 11 N., R. 6 E. Northwest corner of Princeville on east bank of Prince Run Creek.

About 8 feet of gray shale exposed with thin overburden.

Material: shale — Age: Pennsylvanian - Modesto Formation
Water of plasticity, percent 25 — Workability: good
Linear drying shrinkage, percent 5.21

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	5.21	6.25	--
Total linear shrinkage, percent	10.42	11.46	5.21
Fired colors	Salmon	Red	Brown

Remarks: overfired at 2012°F
Suggested uses: structural clay products, drain tile, flower pots, and sewerpipe.

SAMPLES W 143C and W 143D

NE¼ SE¼ NE¼ sec. 8, T. 11 N., R. 9 E. Sampled in 1930. Age: Pennsylvanian - Modesto Formation.

Five and a half feet of Lonsdale Limestone is exposed in a gully and contains a lens of light gray and light tan material (resembling flint clay) up to 1 foot thick; the extent of the lens is unknown. The deposit was sampled because it is unusual in character and occurrence. Sample W 143C was taken from the tan clay and sample W 143D from the light gray clay.

SAMPLE W 143C

Characteristics of Unfired Material

The material is a fairly hard, sandy clay, very light tan in color, has a stony fracture and fair plasticity over a moderate range, and requires 24.2 percent water to develop its normal good working consistency. A modulus of 165 pounds per square inch indicates that the material has a low-medium bonding strength.

It dries fairly rapidly under ordinary atmospheric conditions without difficulty, and has a shrinkage of 5.3 percent.

When slaked and washed on a 40-mesh sieve, 69.9 percent residue remains, consisting partly of unslaked original material resembling flint clay that microscopic examination shows to be quartz grains bonded with a white substance, and partly of brown grains and probable limestone.

Treatment with cold hydrochloric acid causes violent evolution of gas, indicating the presence of carbonates.

Characteristics of Fired Material

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Linear shrinkage % Total
05	33.8	Gray-white		1.1	6.4
02	29.9	Gray-white		2.9	8.2
01	29.5	Gray-white		3.2	8.5

PEORIA COUNTY - continued

SAMPLE W 143C - continued

Characteristics of Fired Material - continued

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Total
2	27.1	Gray-white		3.7	9.0
3	27.1	Light gray		4.0	9.3
6	18.5	Oatmeal	Steel hard	6.8	12.2
8	16.6	Oatmeal	Steel hard	7.5	12.8
9	12.2	Oatmeal	Steel hard	7.7	13.0
11	9.1	Oatmeal	Steel hard	7.7	13.0
14	12.2	Overburned		4.3	9.6

Remarks: this is an open burning material which is overburned at cone 14. The total shrinkage is medium to high-medium. Carbonates are present.
Suggested uses: face or common brick, faience tile, hollow ware, pottery, and architectural terra cotta.

SAMPLE W 143D

Characteristics of Unfired Material

The material is a fairly hard, sandy clay, grayish white and also stained; it has a conchoidal fracture and fair plasticity over a moderate range; it requires 25.5 percent water to develop its normal good working consistency.

It dries fairly rapidly and without difficulty under ordinary atmospheric conditions, and has a shrinkage of 6.8 percent.

When slaked and washed on a 40-mesh sieve, 77.2 percent residue remains, consisting of unslaked original material.

Treatment with hot hydrochloric acid causes moderate evolution of gas, indicating the presence of carbonates.

Characteristics of Fired Material

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Total
05	28.8	Gray-white		3.4	10.2
02	25.5	Gray-white		4.8	11.6
01	24.4	Gray-white		5.1	11.9
2	23.5	Light gray		5.4	12.2
4	21.3	Light gray	Steel hard	6.3	13.1
6	13.1	Dark oatmeal	Steel hard	7.9	14.7
8	11.0	Dark oatmeal	Steel hard	8.7	15.5
9	3.7	Stoneware gray	Steel hard	9.1	15.9
11	0.3	Stoneware gray	Steel hard	8.9	17.7
14	18.0	Stoneware gray	Steel hard	4.3	11.1

Remarks: this material vitrifies slowly, becoming quite dense at cone 9, practically nonabsorbent at cone 11, and overburns decidedly at cone 14. The color changes steadily with comparatively short heat ranges (for brick). The total shrinkages range from medium to high-medium.
Suggested uses: face brick, tile, architectural terra cotta, hollow ware, and stoneware.

PERRY COUNTY

SAMPLE 1323B

NW¼ SE¼ NW¼ sec. 25, T. 4 S., R. 3 W. South cut bank of Swanwick Creek 125 yards west of Pinkneyville-Nashville road crossing.

Approximately 15 feet of medium gray to olive-gray, well laminated shale, lower part darker than upper, more silty near top.

Material: shale
Water of plasticity, percent 23
Linear drying shrinkage, percent 4.42
Age: Pennsylvanian - Modesto Formation
Workability: fair

Fired temperatures	1832°F	1922°F	2012°F
Linear firing shrinkage, percent	4.43	7.56	7.04
Total linear shrinkage, percent	8.85	11.98	11.46
Fired colors	Salmon	Red	Brown

Remarks: overfired at 2012°F
Suggested uses: structural clay products, drain tile, flower pots, and sewerpipe.

SAMPLE 1323A

NE¼ SW¼ NE¼ sec. 5, T. 4 S., R. 4 W. About 2 miles northeast of Coulterville, along east bank of north-flowing tributary to Mud Creek, about one-eighth mile east of road.

Twelve feet of gray-brown grading down into blue-gray, hard, well laminated shale.

Material: shale
Water of plasticity, percent 21
Linear drying shrinkage, percent 3.12
Age: Pennsylvanian - Modesto Formation
Workability: fair

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	3.13	7.81	8.34
Total linear shrinkage, percent	6.25	10.93	11.46
Fired colors	Salmon	Red	Red

Suggested uses: structural clay products, drain tile, flower pots, and sewerpipe.

SAMPLE X

SW¼ NE¼ SW¼ sec. 20, T. 5 S., R. 4 W. Along branch of Rock Fork Creek. Sampled in 1931. Age: Pennsylvanian - Modesto Formation.

The sample was taken from a small outcrop of 2 feet of red, brown, and yellow clay resembling flint clay. The base of the clay is covered; it is overlain by 10 feet of clay and silt except in the stream bed. The clay is sandy, nonbedded, and breaks into irregular fragments with a conchoidal fracture. The clay may be associated with sandstone.

Characteristics of Unfired Material

Material: clay
Color: pink, light buff, pinkish buff, yellowish brown, or black
Working properties: lean
Reaction for carbonates: none
Reaction for pyrites: none
Hardness: 1 on Moh's scale
Drying: air shrinkage, dry basis - linear 6.5 percent

PERRY COUNTY - continued

SAMPLE X - continued

Characteristics of Fired Material

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Total
010		Pink	Does not attain	0.9	7.4
07		Orchid	steel hardness	2.2	8.7
01		Light brown	in this range	3.6	10.1
3	Absorbent	Light tan		4.1	10.6

PCE value (fusion test): cone 18 - brownish black

Remarks

Drying shrinkage: low-medium (plastic basis)
Burning shrinkage: low-medium at cone 4
Vitrification: still absorbent at cone 3; not steel hard
Color range: O. K.
Plasticity: lean

Suggested uses: common, hollow, face, glazed, or enameled brick; fireproofing; quarry, roofing, faience, and tesseral and encaustic tile.

PIKE COUNTY

SAMPLES R 119 and R 120

SE¼ SW¼ sec. 13, T. 7 S., R. 3 W. Cut along Gulf, Mobile, and Ohio Railroad three-fourths mile east of Straut. Sampled in 1930. Age: Pennsylvanian - Spoon Formation.

Sample R 119 was taken from brown clay exposed in ditch along the railroad right-of-way at the west end of the cut; sample R 120 was taken from a red clay exposed in a ditch along the right-of-way at the west end of the cut.

SAMPLE R 119

Characteristics of Unfired Material

This is a medium-hard, dense clay, lemon-tan with occasional deep red mottling. It has a stony fracture. When 28 percent water is added to the material, the mass becomes moderately plastic throughout a medium range. Under ordinary room conditions of temperature and humidity, it dries safely but slowly with a linear shrinkage of 7.6 percent. It has a medium bonding strength with a value of 229 pounds per square inch for the modulus of rupture.

A residue consisting of 82 percent of unslaked material is retained on a 40-mesh sieve. This has the appearance of aggregates of fine quartz particles.

When the clay is tested with dilute hydrochloric acid, there is no reaction. When burned, the clay oxidizes readily.

Characteristics of Fired Material

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Total
04	23.5	Salmon		5.8	13.4
01	17.6	Red	Steel hard	7.7	15.3
1	17.3	Red	Steel hard	7.7	15.3
2	17.2	Red	Steel hard	7.9	15.5
3	15.0	Red	Steel hard	8.4	16.0
6	12.8	Red	Steel hard	8.6	16.2
8	11.2	Red	Steel hard	8.8	16.4
9	8.0	Deep wine-red	Steel hard	6.1	13.7
12	0.7	Deep wine-red	Steel hard	7.5	15.1

PIKE COUNTY - continued

SAMPLE R 119 - continued

Remarks: the porosity changes are uniformly progressive up to cone 8; beyond that point the clay becomes nonporous and apparently is very slightly overburned at cone 12. The colors developed are attractive and sufficiently uniform over a wide range of temperature (cone 01 to cone 9). The total linear shrinkages are high-medium and very uniform throughout the whole range of temperature.
Suggested uses: face brick, common brick, faience tile, hollow ware, and roofing tile.

SAMPLE R 120

Characteristics of Unfired Material

The material is a red clay, consisting of a mixture of hard and soft lumps. When 38.9 percent water is used, a good working consistency is developed. A medium bonding strength is indicated by the modulus of rupture of 229 pounds per square inch.

The moist clay dries slowly under ordinary room conditions without defect, and has a shrinkage of 11.2 percent.

When slaked and washed through a 40-mesh sieve, 7.7 percent residue is retained, which is a hard, white fragment of sandy material and some lignite.

Treatment with dilute hydrochloric acid gave a negative result for carbonates. When burned, the clay oxidizes readily.

Characteristics of Fired Material

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Total
04	13.6	Red		10.4	21.6
01	12.0	Red	Steel hard	12.1	23.3
1	0.4	Red	Steel hard	12.3	23.5
2	0.1	Red	Steel hard	12.3	23.5
3	0.1	Red	Steel hard	12.5	23.7
6	0.8	Red	Steel hard	12.2	23.4
8	0.3	Red	Steel hard	11.9	23.1
9	3.9	Red	Steel hard	6.3	17.5
12	1.3	Red	Steel hard	6.1	17.3

Remarks: this material vitrifies slowly, becoming nonporous at cone 1 and overburning, but not seriously, at cone 9. It possibly may be safely used up to and including cone 12. The total shrinkage is high at all temperatures. The color is very attractive and the commercial burning range is unusually long (cone 04 to cone 9).
Suggested uses: face brick, tile, hollow ware, pottery, sewer brick, and fireproofing.

RANDOLPH COUNTY

SAMPLE NF 208

NE¼ SW¼ SE¼ sec. 24, T. 5 S., R. 5 W. Sampled in 1934. Age: Pennsylvanian - Carbondale Formation.

The sample was taken from a 2-foot exposure of gray and cream clay in a trench in the wall of a creek. The clay is probably overlain by sandstone and may be as much as 4 feet thick.

RANDOLPH COUNTY - continued

SAMPLE NF 208 - continued

Characteristics of Unfired Material

Material: clay
Color: dark gray through silver-gray; some yellow particles
Hardness: medium; fracture coarsely granular
Scumming: none
Working properties: easily worked; firm but not sticky
Water of plasticity, percent: 33.6
Drying conduct: successfully withstood very severe drying conditions

Characteristics of Fired Material

Cone	Absorption %	Color	Hardness
6	1.1	Bright salmon	8

Suggested uses: common and face brick, possibly structural tile.

SAMPLE NF 123

NW¼ NE¼ sec. 34, T. 5 S., R. 6 W. Sampled in 1933. Age: Pennsylvanian - Carbondale Formation.

The sample was taken from the underclay of the Harrisburg (No. 5) Coal at two places 500 feet apart in a mine.

Characteristics of Unfired Material

Material: clay
Reaction for carbonates: negative
Hardness: typical; laminated fracture
Color: dark gray; good uniformity, although some slight brown staining
Working property: works very well

Fineness

Residue, percent: 35-mesh - 1.29
Character of residue: pyrite and bituminous material

Drying

Air shrinkage, percent: linear 11.4
volume 38.3
Drying conduct: satisfactory
Scumming: trace

Characteristics of Fired Material

Cone	Absorption %	Color	Hardness	Remarks
06	4.6	Salmon	4	
02	0.5	Light brown	7	Vitreous fracture
4	24.5	Tan	5	A small black ring near outside surface owing to reduction after previous oxidation; badly bloated

Suggested uses: common and face brick, roofing tile, quarry tile, drain tile, and structural tile unless lamination is serious.

SAMPLE 1338A

NW¼ SW¼ SE¼ sec. 5, T. 7 S., R. 5 W. Near Wine Hill along gully flowing south, due south of church in Wine Hill.

Approximately 10 feet of shale, greenish gray and silty in bottom 2 feet, grades upward to green and purple; less silty and more weathered in upper 8 feet.

RANDOLPH COUNTY - continued

SAMPLE 1338A - continued

Material: shale
Water of plasticity, percent 19
Linear drying shrinkage, percent 3.12
Age: Pennsylvanian - Caseyville Formation
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	2.09	4.17	5.21
Total linear shrinkage, percent	5.21	7.29	8.33
Fired colors	Buff	Buff	Buff

Suggested uses: structural clay products, pottery, drain tile, and flower pots.

SAMPLE 1338B

NW¼ NW¼ SW¼ sec. 6, T. 7 S., R. 5 W. About 1¼ miles west of Wine Hill, in south branch of Hornblasted Branch beside road, about 200 feet south of the southernmost bridge across Hornblasted Branch.

Approximately 9 feet of light brownish gray, well bedded shale; overburden thin.

Material: shale
Water of plasticity, percent 17
Linear drying shrinkage, percent 3.12
Age: Pennsylvanian - Caseyville Formation
Workability: fair

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	2.09	4.69	7.25
Total linear shrinkage, percent	5.21	7.81	9.37
Fired colors	Chocolate	Chocolate	Chocolate

Suggested uses: building blocks and tile, drain tile, and sewerpipe.

SAMPLE 1418

NW¼ NE¼ sec. 32, T. 7 S., R. 6 W. About 2 miles southeast of Chester, west cut bank of Chester and Mt. Vernon Railroad and county road in west valley wall of Mary's River, southeast of Illinois Highway 3.

About 30 feet of dark gray shale, thinly laminated in lower 20 feet, beds massive and cemented in upper 10 feet.

Material: shale
Water of plasticity, percent 24
Linear drying shrinkage, percent 5.21
Age: Mississippian - Waltersburg Formation
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	0.52	2.08	
Total linear shrinkage, percent	5.73	7.29	
Fired colors	Salmon	Red	

Remarks: test samples bloated at 2012°F; organic matter high; might be difficult to oxidize
Suggested uses: drain tile.

RICHLAND COUNTY

SAMPLE 1413

NE corner sec. 14, T. 2 N., R. 10 E. About 1½ miles north of Parkersburg along south-flowing tributary to Sugar Creek, south of unimproved dirt road.

Approximately 3 feet of weathered shale exposed.

RICHLAND COUNTY - continued

SAMPLE 1413 - continued

Material: shale
Water of plasticity, percent 20
Linear drying shrinkage, percent 2.60
Age: Pennsylvanian - Mattoon Formation
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	1.56	2.61	6.77
Total linear shrinkage, percent	4.16	5.21	9.37
Fired colors	Salmon	Salmon	Red

Suggested uses: structural clay products, drain tile, and flower pots.

ROCK ISLAND COUNTY

SAMPLE 1399

NW¼ SE¼ SE¼ sec. 27, T. 17 N., R. 1 W. About 1 mile west of Coal Valley on south cut bank of Coal Valley Creek, south of U. S. Highway 150.

Approximately 25 feet of blue-gray shale.

Material: shale
Water of plasticity, percent 24
Linear drying shrinkage, percent 4.16
Age: Pennsylvanian - Spoon Formation
Workability: good

Fired temperature	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	3.65	4.17	8.30
Total linear shrinkage, percent	7.81	8.33	11.46
Fired colors	Salmon	Salmon	Red

Remarks: scummed
Suggested uses: structural clay products, drain tile, flower pots, and sewerpipe.

SAMPLE 1354A

SW¼ SW¼ SE¼ sec. 6, T. 17 N., R. 5 W. About 2½ miles southeast of Muscatine, Iowa, along north road cut of Illinois Highway 99, on east bluff of Mississippi River.

Approximately 30 feet of dark gray, well laminated shale is exposed.

Material: shale
Water of plasticity, percent 25
Linear drying shrinkage, percent 3.99
Age: Pennsylvanian - Carbondale Formation - Francis Creek Shale
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	3.30	5.38	7.99
Total linear shrinkage, percent	7.29	9.37	11.98
Fired colors	Salmon	Salmon	Red

Remarks: ferrous sulfate scumming; unweathered shales should be free of this scumming; organic content would probably make oxidation difficult
Suggested uses: building tile and drain tile.

ST. CLAIR COUNTY

SAMPLE 1329A

SW¼ NW¼ NW¼ sec. 21, T. 2 N., R. 8 W. About 2 miles east of French Village, west bank of tributary of Little Canteen Creek.

Approximately 16 feet of olive-gray shale grading upward into dark gray shale.

S T. C L A I R C O U N T Y - continued

SAMPLE 1329A - continued

Material: shale
Age: Pennsylvanian - Modesto Formation
Water of plasticity, percent 21
Workability: good
Linear drying shrinkage, percent 2.34

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	2.87	6.51	7.55
Total linear shrinkage, percent	5.21	8.85	9.89
Fired colors	Red	Red	Red

Remarks: scummed
Suggested uses: structural clay products, drain tile, flower pots, and sewerpipe.

SAMPLE 1329B

Center SW¼ SW¼ sec. 21, T. 1 S., R. 7 W. About 1 mile east of Freeburg, north side of road on east side of stream valley.

Ten to 12 feet of gray shale taken from road level to top of shale.

Material: shale
Age: Pennsylvanian - Modesto Formation
Water of plasticity, percent 27
Workability: good
Linear drying shrinkage, percent 4.42

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	5.47	9.64	8.60
Total linear shrinkage, percent	9.89	14.06	13.02
Fired colors	Salmon	Red	Brown

Remarks: overfired at 2012°F
Suggested uses: sewerpipe.

SAMPLE 1333A

NE¼ SW¼ sec. 32, T. 2 N., R. 8 W. Hill Brick Company pit about 3 miles east of Edgemont.

About 40 feet of sandy shale exposed.

Material: shale
Age: Pennsylvanian - Modesto Formation
Water of plasticity, percent 20
Workability: good
Linear drying shrinkage, percent 2.60

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	2.08	3.65	7.29
Total linear shrinkage, percent	4.68	6.25	9.89
Fired colors	Salmon	Red	Red

Suggested uses: structural clay products, drain tile, and flower pots.

SAMPLE 1334A

NW¼ NE¼ sec. 31, T. 2 N., R. 8 W. Hydraulic Press Brick Company pit about 2 miles east of Edgemont.

About 40 feet of blue-gray shale.

Material: shale
Age: Pennsylvanian - Modesto Formation
Water of plasticity, percent 18
Workability: good
Linear drying shrinkage, percent 2.34

S T. C L A I R C O U N T Y - continued

SAMPLE 1334A - continued

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	2.87	9.43	7.03
Total linear shrinkage, percent	5.21	11.77	9.37
Fired colors	Chocolate	Chocolate	Chocolate

Remarks: overfired at 2012°F
Suggested uses: drain tile, building block and tile, and sewerpipe.

S A L I N E C O U N T Y

SAMPLE 1327A

SE¼ SE¼ sec. 21, T. 9 S., R. 6 E. Harrisburg Brick and Tile Company pit south of Harrisburg.

Sample represents lower 8 feet of shale.

Material: shale
Water of plasticity, percent 17
Linear drying shrinkage, percent 2.08
Age: Pennsylvanian - Carbondale Formation
Workability: fair

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	3.13	6.25	7.81
Total linear shrinkage, percent	5.21	8.33	9.89
Fired colors	Salmon	Red	Red

Suggested uses: structural clay products, drain tile, and flower pots.

S A N G A M O N C O U N T Y

SAMPLE 1330 B

Sec. 11, T. 15 N., R. 5 W. Springfield Clay Products pit, southeast part of Springfield.

Approximately 30 feet of massive blue-gray shale.

Material: shale
Water of plasticity, percent 19
Linear drying shrinkage, percent 2.08
Age: Pennsylvanian - Modesto Formation
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	2.09	6.77	8.34
Total linear shrinkage, percent	4.17	8.85	10.42
Fired colors	Salmon	Salmon	Red

Suggested uses: structural clay products, drain tile, and flower pots.

SAMPLE 1332 A

SW¼ sec. 1, T. 15 N., R. 5 W. Poston Brick and Concrete Products Company pit, southeast part of Springfield.

Approximately 35 feet of massive gray shale.

Material: shale
Water of plasticity, percent 19
Linear drying shrinkage, percent 1.82
Age: Pennsylvanian - Modesto Formation
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	0.83	5.99	9.11
Total linear shrinkage, percent	2.65	7.81	10.93
Fired colors	Salmon	Red	Red

Suggested uses: structural clay products, drain tile, and flower pots.

SCHUYLER COUNTY

SAMPLE R 210

N½ SW¼ SW¼ sec. 8, T. 1 N., R. 1 E. Sampled in 1931.

	ft.	in.
Pennsylvanian - Carbondale Formation		
7. Clay, gray, somewhat sandy, poorly bedded	4	9
6. Coal	2	4 ±
Pennsylvanian - Spoon Formation		
5. Clay, gray, poorly bedded	8	9
4. Coal		1-1½
3. Clay, like 5 above		11-22
2. Coal		1-1½
1. Clay, like 5 above	2	5
Covered		

Sample R 210 was taken from beds 1, 3, 5, and 7.

Characteristics of Unfired Material

This clay is a mixture of light and dark grayish materials, with some coaly fragments and concretions. It has a stony fracture.

With the addition of 25 percent water, a soft mass having an "oily" feel and rather low plasticity is developed. When this material is dried under ordinary room conditions, it has a linear shrinkage of 6.7 percent and, owing to a soluble sulfate of iron, a reddish scum appears. Its bonding strength of 152 pounds per square inch is low-medium.

A moderate reaction occurs when the sample is treated with dilute hydrochloric acid. A residue consisting of particles of pyrite, coaly material, quartz grains bonded with calcium carbonate (?), and some unslaked materials amounting to a total of 24 percent was separated on a 40-mesh sieve.

Characteristics of Fired Material

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Linear shrinkage % Total
04	29.3	Light buff		2.2	9.0
01	29.7	Light buff		1.9	8.7
1	28.1	Light buff		2.6	9.4
3	25.6	Light buff		3.5	10.3
6	20.9	Tan	Steel hard	5.3	12.1
8	13.6	Gray-tan	Steel hard	7.1	13.9
9	8.7	Stoneware gray	Steel hard	7.6	14.4
11	11.3	Stoneware gray	Steel hard	4.9	11.7
14	13.5	Brown fused surface	Steel hard	1.4	5.4

Remarks: the clay oxidized readily and vitrified rather slowly with a low or medium total shrinkage. The minimum porosity was reached at cone 9 and apparently slight overburning occurred above that point. An unsightly red scum owing to soluble salts appears on the dried pieces and is conspicuous from cone 04 to cone 9. This will interfere with the use of the clay for many purposes.
Suggested uses: common brick and hollow ware.

SAMPLE R 516

NE¼ SW¼ NE¼ sec. 32, T. 2 N., R. 1 E. Cut along Chicago, Burlington, and Quincy Railroad. Sampled in 1932. Age: Pleistocene.

Three and one-half feet of noncalcareous loess in cut; overlain by 14 feet of other unconsolidated materials.

SCHUYLER COUNTY - continued

SAMPLE R 516 - continued

Characteristics of Unfired Material

Reaction for carbonates: none
Reaction for pyrites: none
Color: light brown
Hardness: soft; crumbled in fingers
Working properties: lean; does not weld
Water of plasticity, percent: 23.7
Modulus of rupture: 540 lbs. per sq. in. - 11 specimens

Fineness

Residue, percent: 48-mesh - 0.8
Character of residue: chiefly limonite and some quartz

Drying

Air shrinkage, plastic basis, percent: 3.4
Dry basis, percent: linear 4.4 volume 12.6

Characteristics of Fired Material

Cone	Absorption %	Color	Hardness	Linear shrinkage % Burning	Total
010	18.1	Salmon		0.6	3.8
07	18.5	Salmon		0.7	3.7
01	9.9	Grayish brown		3.7	8.1) color
3	3.4	Dark brown	Steel hard	7.8	12.2) uniform

Remarks

Drying shrinkage: low (plastic basis)
Flexural strength: high-medium; quite exceptional for such lean material
Burning shrinkage: medium at cone 3
Color range: O. K.
Plasticity: poor; doubtful it can be extruded
Vitrification: slow, porosity cone 3 - 3.4 percent

Suggested uses: common brick.

SAMPLE 1410

SE¼ SW¼ SW¼ sec. 27, T. 2 N., R. 2 W. About 2 miles west of Rushville, north cut bank of road in east valley wall of Harvey Branch.

Approximately 20 feet of light blue-gray shale.

Material: shale
Water of plasticity, percent 18
Linear drying shrinkage, percent 2.08
Age: Pennsylvanian - Carbondale Formation - Francis Creek Shale
Workability: fair

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	3.13	3.65	8.91
Total linear shrinkage, percent	5.21	5.73	10.99
Fired colors	Salmon	Salmon	Red

Remarks: overfired at 2012°F
Suggested uses: structural clay products, drain tile, and flower pots.

SCOTT COUNTY

SAMPLE R 129

SE¼ SE¼ SW¼ sec. 23, T. 15 N., R. 13 W. Sampled in 1930.

SCOTT COUNTY - continued

SAMPLE R 129 - continued

Pennsylvanian - Spoon Formation	ft.	in.
5. Limestone, cobbles and boulders	3±	
4. Fire clay, medium gray	4	6
3. "Coal bloom"		6±
2. Shale, gray and black (sample R 129)	10-11	
1. Limestone	2	6

Characteristics of Unfired Material

This is a mixture of approximately one-quarter black, soapy and three-quarters gray, sandy clays. The black portion is medium-hard and has a conchoidal fracture. The gray is sandy and hard and has a stony fracture.

When 29 percent water is added to the material, it develops a good plasticity. This mass dries moderately rapidly under ordinary conditions and has a linear shrinkage of 9.3 percent, but a considerable scum appears. It has a medium bonding strength with a value of 201 pounds per square inch.

The clay is slaked in water and sieved through a 40-mesh sieve; 25 percent of residue is collected, consisting largely of unslaked material with some lignitic particles. The clay burns satisfactorily without any difficulty in oxidation.

Characteristics of Fired Material

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Linear shrinkage % Total
05	27.7	Light yellow		3.2	12.5
01	26.8	Light yellow		3.6	12.9
1	26.1	Light yellow		4.1	13.4
2	26.3	Light yellow		4.2	13.5
4	24.7	Yellow	Steel hard	4.7	14.0
6	22.9	Light buff	Steel hard	5.1	14.4
8	21.6	Light buff	Steel hard	5.3	14.6
9	19.0	Light buff	Steel hard	6.2	15.5
12	13.8	Tan with black specks	Steel hard	7.3	16.6
14	1.7			8.0	17.3

Remarks: this is a refractory clay with a PCE of cone 27. When burned it has a high porosity which is not much decreased until cone 9 is passed. The linear burning shrinkages are low to medium within that range. When a temperature above cone 12 is reached, the clay becomes virtually nonabsorbent. The color varies consistently from a yellow-buff to a tan (at cone 12) but a scum darkens the color above cone 4.

Suggested uses: the clay appears best adapted for use for refractories intended for moderate requirements. The presence of the scum lessens its value for many wares. Possibly it may be useful for hollow ware.

SHELBY COUNTY

SAMPLE 1422

NW cor. sec. 24, T. 11 N., R. 3 W. About 1 mile southwest of Shelbyville on east road cut in south valley wall of creek.

Approximately 6 feet of shale exposed, overburden thin.

Material: shale
Age: Pennsylvanian - Mattoon Formation
Water of plasticity, percent 20
Workability: fair
Linear drying shrinkage, percent 2.60

SHELBY COUNTY - continued

SAMPLE 1422 - continued

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	2.61	3.13	7.29
Total linear shrinkage, percent	5.21	5.73	9.89
Fired colors	Salmon	Salmon	Red

Suggested uses: structural clay products, drain tile, and flower pots.

STARK COUNTY

SAMPLE 1398

NE¼ NW¼ sec. 25, T. 13 N., R. 6 E. About three-fourths of a mile north of Wyoming; south cut bank of tributary to Spoon River on south side of road.

Approximately 8 feet of shale exposed.

Material: shale
Water of plasticity, percent 19
Linear drying shrinkage, percent 2.56
Age: Pennsylvanian - Carbondale Formation
Workability: fair

Fired temperature	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	0.56	1.08	6.81
Total linear shrinkage, percent	3.12	3.64	9.37
Fired colors	Salmon	Salmon	Red

Remarks: overburned at 2012°F
Suggested uses: structural clay products, drain tile, and flower pots.

TAZEWELL COUNTY

SAMPLE R 220

N½ N½ sec. 5, T. 25 N., R. 4 W. Sampled in 1931. Age: Pennsylvanian - Carbondale Formation.

		ft.	in.
4.	Glacial clay overburden		
3.	Shale	2	6
2.	Clay, calcareous	7	
1.	Shale, gray, with scattered ferruginous concretions (sample R 220)	13	6
	Covered		

Characteristics of Unfired Material

The material is a mixture of fairly hard, uniformly gray shale, and it has a hackly to conchoidal fracture, with a sandy shale having a stony fracture. The mixture has fair plasticity over a moderate range, and requires 27.6 percent water to develop a normal, good working consistency. A low-medium bonding strength is indicated by a modulus of rupture of 134 pounds per square inch.

It dries slowly without difficulty under ordinary atmospheric conditions and has a shrinkage of 6.4 percent.

When slaked and washed on a 40-mesh sieve, 10.8 percent residue remains which consists of unslaked original material, some mica, and some pyrite in small grains and bonded into aggregates.

Treatment with hot hydrochloric acid causes mild evolution of gas, indicating the presence of carbonates. When burned, the clay oxidizes readily.

TAZEWELL COUNTY - continued

SAMPLE R 220 - continued

Characteristics of Fired Material

Cone	Porosity %	Color	Hardness	Linear shrinkage % Burning	Total
07	18.1	Salmon		6.1	12.5
02	0.3	Reddish brown	Steel hard	10.4	16.8
2	0.3	Reddish brown	Steel hard	10.0	16.4
3	0.3	Brown	Steel hard	9.0	15.4
6	0.4	Black-brown, glazed and rough	Steel hard	8.0	14.4

Remarks: the material is well vitrified at cone 02 and does not show definite overburning until cone 3 is passed. The total shrinkages are high. The product is hard and has a satisfactory uniformly even color from cone 02 upwards. Some small particles of iron pyrites are present.
Suggested uses: sewer brick, tile, and hollow ware.

SAMPLE 1322B

NW¼ NE¼ sec. 5, T. 25 N., R. 4 W. Peoria Brick and Tile Company pit, south of East Peoria.

Sample taken from shale bin.

Material: shale
Water of plasticity, percent 19
Linear drying shrinkage, percent 2.60
Age: Pennsylvanian - Carbondale Formation
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	2.08	4.69	5.73
Total linear shrinkage, percent	4.68	7.29	8.33
Fired colors	Salmon	Salmon	Red

Suggested uses: structural clay products, drain tile, and flower pots.

UNION COUNTY

SAMPLE 1335A

NE¼ SW¼ NE¼ sec. 11, T. 13 S., R. 2 W. About 3½ miles southwest of Jonesboro; cut in southeast bank of creek along west fork of road.

Approximately 50 feet of pinkish brown to tan to maroon to light gray, massive to poorly bedded and to thinly bedded shale; top more silty than bottom.

Material: shale
Water of plasticity, percent 25
Linear drying shrinkage, percent 3.12
Age: Mississippian - Springville Shale
Workability: fair

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	1.56	5.73	10.42
Total linear shrinkage, percent	4.68	8.85	13.54
Fired colors	Light salmon	Salmon	Red

Suggested uses: structural clay products, drain tile, flower pots, and sewerpipe.

VERMILION COUNTY

SAMPLE 1343A

E½ sec. 4, T. 19 N., R. 12 W. Harmattan Mine of Fairview Collieries about 1 mile west of Hillery.

Lower 10 feet of blue-gray shale.

Material: shale
Water of plasticity, percent 20
Linear drying shrinkage, percent 2.77
Age: Pennsylvanian - Modesto Formation - Farmington Shale
Workability: fair

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	6.61	8.69	--
Total linear shrinkage, percent	9.38	11.46	--
Fired colors	Salmon	Red	

Remarks: considerably overfired at 2012°F
Suggested uses: sewerpipe and structural clay products.

SAMPLE 1343B

Same location as sample 1343A.

Upper 10 feet of weathered shale.

Material: shale
Water of plasticity, percent 18
Linear drying shrinkage, percent 2.60
Age: Pennsylvanian - Modesto Formation - Farmington Shale
Workability: fair

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	3.65	4.17	5.21
Total linear shrinkage, percent	6.25	6.77	7.81
Fired colors	Salmon	Salmon	Red

Remarks: scumming; overfired at 2012°F
Suggested uses: structural clay products, drain tile, and flower pots.

SAMPLE 1342A

NW¼ NE¼ sec. 14, T. 19 N., R. 12 W. Western Brick Company pit, about 1 mile southeast of Batestown.

About 25 feet of shale.

Material: shale
Water of plasticity, percent 22
Linear drying shrinkage, percent 2.62
Age: Pennsylvanian - Modesto Formation - Farmington Shale
Workability: good

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	3.11	6.76	6.76
Total linear shrinkage, percent	5.73	8.33	9.38
Fired colors	Salmon	Red	Red

Remarks: overfired at 2012°F
Suggested uses: structural clay products, drain tile, and flower pots.

WARREN COUNTY

SAMPLE NF 378

NE¼ SW¼ NW¼ sec. 14, T. 9 N., R. 1 W. Sampled in 1935.

WARREN COUNTY - continued

SAMPLE NF 378 - continued

Section exposed on the north side of Cedar Creek:	ft.	in.
Covered	10-15	
Pennsylvanian - Spoon Formation		
4. Coal	1+	
3. Shale or clay (sample NF 378)	8	6
2. Coal blossom		2-4
1. Chert, rubble from Burlington (Mississippian) Limestone		4
Covered		

Characteristics of Unfired Material

Color: light gray; some dark gray intermixed
Hardness: most crumbles readily between the fingers, but part is hard and shaly
Reaction for carbonates: cold - negative; hot - negative
Reaction for pyrite: negative
Soluble salts: sulfates feeble
Working properties: very good
Drying shrinkage, percent: linear 8.1; volume 26.2
Drying conduct: easy to dry
Fracture: most of it has a granular fracture; some has a fissile fracture
Screen test: residue on 35-mesh screen - 0.25 percent; 90 percent sandstone, quartz, and root casts, and some limonite and roots

Characteristics of Fired Material

Cone	Absorption %	Porosity %	Color	Hardness	Burning shrinkage % Linear	Burning shrinkage % Volume	Remarks
06	16.7	29.3	Peach	3	1.2	3.6	
2	4.2	9.4	Light tan	8	9.0	24.6	Slightly scummed on edges
3		7.3	Light buff	8	9.1	24.7	
6	0.15	0.3	Greenish buff	9	10.7	28.7	Tends to warp slightly during vitrification

Oxidation conduct: requires moderately long oxidation period
Soluble salts: sulfates trace
Warpage: tends to warp slightly during vitrification
Suggested uses: buff face brick, stoneware, and terra cotta.

SAMPLE NF 377

Center W½ NW¼ sec. 10, T. 9 N., R. 2 W. Sampled in 1935. Age: Pennsylvanian.

Section exposed in south bank of Cedar Creek east of the road:	ft.	in.
Covered	20-30	
Pennsylvanian - Spoon Formation		
7. Sandstone, fine-grained, thin-bedded	2	
6. Coal (Wiley Coal?)		8
5. Underclay, gray	5	6
4. Coal		2-4
3. Underclay, gray	4	
2. Limestone, dark gray, dense		0-8
1. Clay, cream (sample NF 377)	2+	

WARREN COUNTY - continued

SAMPLE NF 377 - continued

Characteristics of Unfired Material

Color: gray
Hardness: medium
Fracture: irregular
Reaction for carbonates: cold - negative
hot - negative
Reaction for pyrite: negative
Working properties: good
Drying shrinkage, percent: linear 8.2
volume 26.8
Drying conduct: good
Screen test: residue on 35-mesh screen - 0.11 percent; brown, red, white, gray, and black sandstone; considerable gritty material passed 35-mesh

Characteristics of Fired Material

Cone	Absorption %	Porosity %	Color	Hardness	Burning shrinkage % Linear	Volume
06	19.9	33.3	Pinkish white	3	1.8	5.3
3	11.8	22.6	Light cream	5	4.9	13.9
7	4.5	9.9	Gray to tan	8	9.1	25.0

Oxidation conduct: no difficulty
Soluble salts: none detected
Suggested uses: face brick, common brick, stoneware, or conduits.

SAMPLE NF 376

NE¼ NW¼ NE¼ sec. 35, T. 12 N., R. 3 W. Sampled in 1935. Age: Mississippian - Kinderhook Shale.

The sample, taken from 4 feet of greenish brown shale, was exposed in a gully. The shale occurs in the upper part of the Kinderhook Formation.

Characteristics of Unfired Material

Color: yellow buff
Hardness: 1½; unshattered by fingers
Fracture: angular to conchoidal
Reaction for carbonates: cold - strong
hot - trace
Reaction for pyrite: negative
Soluble salts: sulfates - small amount
Working properties: excellent
Drying shrinkage, percent: linear 8.9
volume 29.2
Drying conduct: good; no difficulty noted
Screen test: residue on 35-mesh screen - 5.0 percent; limestone pebbles and some limonite

Characteristics of Fired Material

Cone	Absorption %	Porosity %	Color	Hardness	Burning shrinkage % Linear	Volume	Remarks
06	23.0	37.0	Salmon	4	1.0	3.1	Several lime pops
02	22.0	36.0	Light buff	5	1.1	3.3	Cream spots; traces of scum
2	21.0	34.5	Light tan	6	1.8	5.3	Trace of scum; one iron pop
6	0.5	1.2	Chocolate brown	9	9.5	25.8	Pretty well vitrified; would soon fuse

Oxidation conduct: satisfactory
Soluble salts: trace
Warpage: none
Suggested uses: face brick, hollow tile, and common brick.

WASHINGTON COUNTY

SAMPLE 1339A

SE¼ SW¼ SW¼ sec. 18, T. 2 S., R. 4 W. About 7½ miles east of St. Libory, roadcut west side of Elkhorn Creek.

Approximately 12½ feet of olive-gray, clayey, fairly well bedded shale with plant fossils and ironstone concretions.

Material: shale
Water of plasticity, percent 24
Linear drying shrinkage, percent 3.90
Age: Pennsylvanian - Modesto Formation
Workability: fair

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	4.95	7.03	7.56
Total linear shrinkage, percent	8.85	10.93	11.46
Fired colors	Salmon	Red	Red

Suggested uses: structural clay products, drain tile, and sewerpipe.

WHITE COUNTY

SAMPLE 1409

NW¼ SW¼ SW¼ sec. 11, T. 5 S., R. 9 E. About 1 mile northwest of Carmi, about 200 yards east of road on south bank of Big Hill Branch.

Approximately 8 feet of dark gray shale exposed.

Material: shale
Water of plasticity, percent 17
Linear drying shrinkage, percent 1.04
Age: Pennsylvanian - Mattoon Formation
Workability: poor

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	3.12	3.65	9.38
Total linear shrinkage, percent	4.16	4.69	10.42
Fired colors	Salmon	Salmon	Brown

Remarks: poor workability, scumming, oxidization difficulties.

WHITESIDE COUNTY

SAMPLE NF 411

Center W line, NW¼ sec. 3, T. 22 N., R. 4 E. Sampled in 1938. Age: Pennsylvanian?

The sample from 2 feet of gray clay - in places blotched purple, pink, and green - exposed in roadcut. The clay rests on Niagaran dolomite and contains scattered masses of rotted dolomite. It is not clear whether the clay is a residuum from the weathering of dolomite or is slumped from a higher deposit and the rotted dolomite incorporated during the process. Dolomite was excluded from the clay sampled.

Characteristics of Unfired Material

Color: gray with faint greenish cast
Hardness: breakable by hand with difficulty
Fracture: tends to break into angular fragments
Reaction for carbonates: cold - none
hot - none
Reaction for pyrite: not detected
Soluble salts: sulfates present
Working properties: very good
Water of plasticity, percent: 25.6
Shrinkage water, percent: 13.9
Pore water, percent: 11.7

WHITESIDE COUNTY - continued

SAMPLE NF 411 - continued

Slaking time: 100 percent clay - 19½ minutes; 50 percent clay — 50 percent flint - 70 minutes
Drying shrinkage, percent: linear 8.0; volume 26.1
Drying conduct: excellent; no tendency to warp or crack noted; a little scum was noted on the drying bars, but it could not be seen on the fired bars
Modulus of rupture: dry clay - 418 lbs. per sq. in. - 12 specimens; with 50 percent standard sand - 226 lbs. per sq. in. - 15 specimens

Screen test:

Residue on	Percent	Character of residue
10-mesh	0.10	Quartz grains cemented with clay; limonite replacing wood
20-mesh	0.16	Quartz grains cemented with clay; trace of limonite; some lignite
35-mesh	0.75	Same as on 20-mesh
65-mesh	1.60	Clean, clear quartz grains; some limonite; some lignite
100-mesh	0.88	Same as on 65-mesh
150-mesh	0.80	Same as on 65-mesh
200-mesh	0.93	Clear, white quartz sand; some lignite; some biotite

Characteristics of Fired Material

Cone	Absorption %	Porosity %	Color	Hardness	Burning shrinkage % Linear	Burning shrinkage % Volume	Total shrinkage % Linear	Total shrinkage % Volume
011	16.2	29.3	Light cream	2	1.5	4.3	9.5	30.4
06	15.2	26.0	Gray-white	3	3.3	9.7	11.3	35.8
02	11.7	20.1	Poor white	7	5.1	14.5	13.1	30.6
4	6.2	13.6	Poor white	8	7.7	21.3	15.7	47.4
7	3.6	7.9	Poor white	9	9.7	26.3	17.7	52.4
9	1.1	2.7	Gray-white	9	9.9	26.9	17.9	53.0

Oxidation conduct: easy to oxidize PCE value (fusion test): cone 32
Warpage: none noted
Remarks: a plastic fire clay of exceptional white color, the material is not an open-burning clay, but becomes vitrified at about cone 9, and presumably has a fairly long vitrifying range. Classed as No. 2 fire clay because of its vitrifying characteristics and because of its high PCE (cone 32), the clay also possesses the characteristics of a refractory bond clay and a ball clay, both of which are usually No. 2 fire clays. The color is good and it is fairly well vitrified at cone 9, but the dry strength is not very high. It has good forming, drying, and firing characteristics.
Suggested uses: the clay can be used as a bond clay for refractories, saggers, glass pots, crucibles and,in some cases, as a ball clay. It would be especially useful as a bond clay of rather low iron content and fairly high maturing temperatures, for example, some glass house refractories. It would be useful for face brick, terra cotta, and some types of pottery.

WILL COUNTY

SAMPLE NF 396

NW¼ SW¼ SW¼ sec. 30, T. 33 N., R. 9 E. Sampled in 1936. Age: Pennsylvanian - Spoon Formation.

The sample is taken from a 4-foot cut in the underclay of Colchester (No. 2) Coal in the floor of a pit of Northern Illinois Coal Corporation.

Characteristics of Unfired Material

Color: gray, streaks of black, carbonaceous material
Hardness: fairly hard
Fracture: irregular
Reaction for carbonates: cold - very slight
Screen test: residue on 35-mesh - 1.35 percent; silica; black and brown carbonaceous material
Working properties, manual: very plastic
Drying shrinkage, percent: linear 6.71 volume 18.66
Drying conduct: good; no warping; no noticeable scum

Characteristics of Fired Material

Cone	Absorption %	Color	Hardness	Burning shrinkage % Linear	Burning shrinkage % Volume	Remarks
06	14.35	Bright orange-red	2	0.72	0.57	Trace of scum
02	7.63	Brown-red	6	4.05	8.63	Trace of scum
4	0.60	Chocolate brown	8	5.71	15.54	No scum; slight overfiring

Oxidation conduct: good; complete in heating-up period
Remarks: color not of good grade for face brick; lacks redness and brilliance. High plasticity and drying shrinkage might cause some trouble in manufacturing. Firing behavior is satisfactory, and the material matures between cones 02 and 1 but does not readily overfire.
Suggested uses: common brick, building tile, and drain tile.

SAMPLE DS 96

Center SE¼ sec. 32, T. 33 N., R. 9 E. In pit of Northern Illinois Coal Corporation. Sampled in 1931. Age: Pennsylvanian - Carbondale Formation - Francis Creek Shale.

The strata exposed are:	ft.	in.
3. Soil, sandy, black	1	6
2. Sand and gravel	3	
1. Shale, gray, slightly gritty, containing concretions (sample DS 96)	33	
Covered		

Characteristics of Unfired Material

Color: light gray
Hardness: soft
Fracture: smooth to crumbly
Reaction for carbonates: cold, very slight
Working properties: manual - very plastic; rubbery
Drying shrinkage, percent: linear 5.28 volume 15.27
Drying conduct: good; no tendency to warp; no noticeable scum
Screen test: residue on 35-mesh screen - 0.334 percent; mainly silica

WILL COUNTY - continued

SAMPLE DS 96 - continued

Characteristics of Fired Material

Cone	Absorption %	Color	Hardness	Burning shrinkage % Linear	Burning shrinkage % Volume	Remarks
06	15.75	Pink-red	3	2.81	8.49	Considerable scum
02	6.02	Pale red	7	7.73	22.17	Considerable scum
4	0.10	Dark chocolate brown	9	10.53	30.33	No scum; much overfired

Oxidation conduct: oxidized readily in heating-up period
Remarks: material has a fair color in firing but is lacking in brilliance or intensity of the red color. Both drying and firing shrinkages are rather high. Maturing in firing occurs between cones 02 and 1, and overfiring is evident at cone 4 or lower.
Suggested uses: common brick, building tile, and drain tile.

SAMPLE NF 389

East line, NE¼ SW¼ NE¼ sec. 16, T. 34 N., R. 9 E. Sampled in 1936. Age: Ordovician - Maquoketa Shale.

Shale exposed in a cut along west side of road in the lower part of the north slope of a hill:

		ft.
3.	Earth	1-2
2.	Siltstone, brown; limestone, dolomite, and clay	4-6
1.	Siltstone, greenish, calcareous, thin-bedded, shaly with local hard layers (sample NF 389 from several 6-foot exposures of bed 1)	6
	Covered	

Characteristics of Unfired Material

Color: green
Hardness: fairly hard
Fracture: conchoidal
Reaction for carbonates: cold - considerable
Working properties, manual: very plastic
Drying shrinkage, percent: linear 5.86 volume 23.22
Drying conduct: no warping; no visible scum
Screen test: residue on 35-mesh - 2.69 percent; silica; green transparent particles, iron compounds

Characteristics of Fired Material

Cone	Absorption %	Color	Hardness	Burning shrinkage % Linear	Burning shrinkage % Volume	Remarks
06	10.55	Light brownish red	7	0.71	12.17	Very slight scum
02	0.15	Brownish red	7	8.77	26.12	Very slight scum
4	0.0	Light chocolate brown	8	9.25	27.15	No scum; slight overfiring

WILL COUNTY - continued

SAMPLE NF 389 - continued

Remarks: color not satisfactory for good red ware at any point in firing range; at the maturing range, about cone 02, brown is predominant. The drying and firing shrinkages are rather high, requiring some care in drying and firing, but otherwise the properties are satisfactory.
Suggested uses: common brick, building tile, and drain tile.

WILLIAMSON COUNTY

SAMPLE 1419

S½ N½ sec. 21, T. 9 S., R. 4 E. Delta Mine of Carmi Coal Company, about 2 miles east of Craborchard.
Approximately 20 feet of blue-gray shale.

Material: shale — Age: Pennsylvanian - Carbondale Formation
Water of plasticity, percent 12 — Workability: poor
Linear drying shrinkage, percent 2.60

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	5.73	4.69	6.77
Total linear shrinkage, percent	8.33	7.29	9.37
Fired colors	Salmon	Salmon	Red

Remarks: overfired at 2012°F
Suggested uses: structural clay products, drain tile, and flower pots.

SAMPLE 1417

SE¼ SE¼ sec. 25, T. 10 S., R. 3 E. About one-half mile east of Creal Springs, east face of old stone quarry.
About 3 feet of gray clay.

Material: underclay — Age: Pennsylvanian - Spoon Formation
Water of plasticity, percent 25 — Workability: good
Linear drying shrinkage, percent 3.12

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	1.56	1.56	5.21
Total linear shrinkage, percent	4.68	4.68	8.33
Fired colors	Cream	Cream	Cream

Suggested uses: pottery, structural clay products, and sewerpipe.

SAMPLE 1429

Same location as sample 1417 but below that sample.
Approximately 6 feet of gray shale.

Material: shale — Age: Pennsylvanian - Spoon Formation
Water of plasticity, percent 22 — Workability: fair
Linear drying shrinkage, percent 2.60

Fired temperatures	1832°F	1922°F	2012°F
Linear fired shrinkage, percent	1.04	2.61	6.78
Total linear shrinkage, percent	3.64	5.21	9.38
Fired colors	Buff	Buff	Brown

Suggested uses: structural clay products and drain tile.

COOK COUNTY

SAMPLE NF 230

NW¼ NE¼ SE¼ sec. 11, T. 36 N., R. 12 E. Sampled in 1934 from a roadcut; the material is a clay deposited in ancient Orland Lake in front of the Tinley end moraine. Age: Pleistocene - Wisconsinan.

The beds exposed are:	ft.	in.
3. Soil		6
2. Clay and soil mixed	1	6
1. Clay, gray and brown, calcareous, locally slightly laminated (sample NF 230)	7	
Covered		

Characteristics of Unfired Material

Material: Orland Lake clay
Reaction for carbonates: yes
Reaction for pyrites: no
Color: light buff, yellowish tint
Soluble salts: sulfates present
Drying shrinkage, percent: linear 7.4
volume 24.1
Drying conduct: satisfactory; slight tendency to crack if dried too rapidly
Friability: easily crumbled; can be powdered between the fingers
Working properties: excellent
Water of plasticity, percent: 28.6
Shrinkage water, percent: 13.2
Pore water, percent: 15.4
Slaking time: 100 percent clay - 15 minutes; 50 percent clay — 50 percent flint - 4 minutes, 30 seconds

Modulus of rupture	Lbs. per sq. in.	No. of specimens
Dry clay	801	14
With 50 percent standard sand	196	13

Screen test:

Residue on	Percent	Character of residue
10-mesh	0.69	Limestone and sandstone
20-mesh	0.93	Limestone, sandstone, and quartz
35-mesh	0.19	Limestone, sandstone, quartz, and a few roots
65-mesh	0.15	Calcite and quartz
100-mesh	0.05	Calcite and quartz
150-mesh	0.09	Calcite and quartz
200-mesh	0.16	Calcite and quartz

Characteristics of Fired Material

Cone	Absorption %	Porosity %	Color	Hardness	Burning shrinkage % Linear	Burning shrinkage % Volume	Total shrinkage % Linear	Total shrinkage % Volume
011	14.4	35.8	Salmon	3	0.84	2.5	8.30	26.6
06	13.1	32.5	Salmon	3	1.22	3.6	8.68	27.7
02	10.8	20.4	Reddish buff	7	5.80	16.4	13.26	40.5
2	4.9	10.5	Red	8	9.43	25.7	16.89	49.8
3	2.4	5.1	-	-	12.37	32.7	19.83	56.8
4	0.1	0.3	Greenish brown	9	14.36	37.2	21.82	61.3
5	Melts							

COOK COUNTY - continued

SAMPLE NF 230 - continued

Oxidation conduct: easy to oxidize Soluble salts: slight scumming
PCE value (fusion test): cone 5; cones made from this clay do not bend but they squat or melt suddenly
Warpage: no tendency to warp
Remarks: nonrefractory, burns to a buff or light red (dependent on atmosphere of kiln). In highly oxidizing atmospheres, good reds can be produced. The clay has a very short maturing range; if fired above cone 4 it melts. Limestone particles cause the burned clay to be freckled with cream-colored spots that develop lime pops in cases where the clay has not been exceptionally hard burned.
Suggested uses: common brick and drain tile.

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CIRCULAR 303

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